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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 2471
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2471
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 2474
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 2475
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2475
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 2475
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2476
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL 2476

Note: N.A. means that no abstracts were assigned to this category for this issue.

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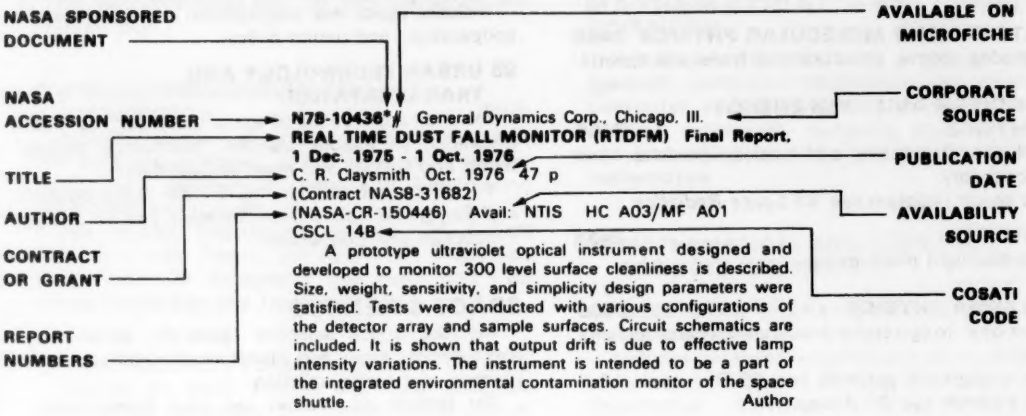
TYPICAL CITATION AND ABSTRACT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REAL TIME DUST FALL MONITOR (RTDFM) Final Report, 1 Dec. 1975 - 1 Oct. 1976
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COSATI CODE
A prototype ultraviolet optical instrument designed and developed to monitor 300 level surface cleanliness is described. Size, weight, sensitivity, and simplicity design parameters were satisfied. Tests were conducted with various configurations of the detector array and sample surfaces. Circuit schematics are included. It is shown that output drift is due to effective lamp intensity variations. The instrument is intended to be a part of the integrated environmental contamination monitor of the space shuttle.
Author
REPORT NUMBERS

ON-GOING RESEARCH PROJECTS

This is a listing of research projects — not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, ENHANCED INTERACTIVE GRAPHICS STRUCTURAL COST MODEL

B.H. OMAN, General Dynamics Corporation, *San Diego, California* 92112 (DF136900; F33615-76-C-3080)

The Air Force, in order to maintain air superiority, must obtain advanced aerospace vehicles and modify existing systems. Reliable cost and weight analysis is required if these systems are to have the minimum cost for the acceptable level of performance. The objective of this task is to provide an integrated analysis model using interactive graphics computer program so that accurate cost and weight assessments may be made in a short time.

This effort will extend the capabilities and improve the efficiency of the cost and weight interactive graphics computer program, delivered to the Air Force under contract F33615-75-C-0113. The improvements to be made will allow analysis of composite structures, and will make the program efficient by setting up a universal interdisciplinary data base and by restructuring the program into a modular form. The results of the effort will be documented in a final report which will include a technical report and a user's manual. The upgraded computer program will be installed and checked out on the ASD Cyber 74 computer.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0002, AIRCRAFT FUEL TANK ENVIRONMENT/THREAT EFFECTS MODEL FOR VULNERABILITY ASSESSMENT

L. MAHOOD, Falcon Research & Dev. Company, *Denver, Colorado* 80218 (DF457080; F33615-74-C-2057)

The objectives of this program are: 1. To collect and analyze existing data that relate to aircraft fire and explosion and to develop probability of fire and explosion information which is applicable to existing vulnerability analysis programs, 2. Review current vulnerability analysis programs and determine their usefulness for predicting probability of a fire and explosion, and 3. Develop a computer program and associated models which incorporate the germane parameters necessary to predict fire and explosion factors in a realistic military aircraft combat environment.

The program shall consist of four tasks. Task I shall consist of a review and analysis of existing data related to fuel system fire and explosion hazards. Task II shall consist of a review and analysis of current existing computer programs for vulnerability analysis. Task III shall constitute the majority of the effort. It shall be directed towards the detailed investigation of the parameters that affect the probability of a fire or explosion within aircraft in a combat environment. Task IV will involve the check-out and refinement of the computer program developed in task III. The fire and explosion probability information developed in task I should be directly applicable to the type vulnerability programs studied in task II as well as a departure point for task III. The computer program resulting from task III should, if possible, be applicable to the vulnerability programs of task II; however, this should not be considered as a constraint. The results of task II should establish how the results of task III may be utilized in assessing total aircraft vulnerability.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0003, AIRCRAFT FUEL TANK SIMULATOR FOR FIRE

L. MAHOOD, Falcon Research & Dev. Company, *Denver, Colorado* 80218 (DF457760; F33615-76-C-2042)

Design, development, construction and checkout of an aircraft fuel tank simulator that permits realistic measurements of ullage composition and system response to combat-induced threats.

The program is structured into three major tasks. Task I consists of the design effort. During this task, the contractor is required to present four design reviews--the conceptual, preliminary, major, and final. If after the major design review the design is acceptable, the contractor shall proceed to final drawing and task II. This task is for construction and installation of the fuel tank simulator. Task III shall be the demonstration of system capabilities and training of USAF personnel to operate the system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0004, FULL-SCALE STATIC TESTING OF AN INTERNAL MIXER FOR THE PRATT AND WHITNEY JT8D AIRCRAFT ENGINE

UNKNOWN, United Technologies Corp., *Hartford, Connecticut* 06108 (FA77WA-4048; FA160425 (TRAIS NO.))

The mixer shall be installed on a JT8D engine and tested on a performance stand to establish an acceptable engine primary/secondary match. With the mixer hardware in this properly matched position, engine flow parameters such as corrected thrust, N1, N2, EPR, EGT, NPR, airflow, bypass ratio, etc., shall be determined. Engine parameter data shall be acquired for at least ten thrust settings approximately equally spaced from idle to JT8D takeoff power.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0005, AIRCRAFT/WEAPON PERFORMANCE, STABILITY AND CONTROL

R.E. VANPUTTE, U.S. Air Force, Armament Laboratory, *Eglin Air Force Base, Florida* 32542 (DF626580)

To improve present methods and develop new techniques to predict the effects of external store carriage on the performance, stability, and control of aircraft/store combinations.

To review and analyze wind tunnel and flight test data, analytical investigations, and empirical research studies in order to identify external weapon parameters which affect carrier aircraft aerodynamic characteristics. Wind tunnel data will be obtained from AEDC with existing and proposed weapons installed on wind tunnel models of the F-4, A-7, F-15 and other aircraft. Specific stability and control study areas will include: 1. Longitudinal static stability, 2. Lateral-directional stability, 3. Control effectiveness, and 4. Effect of weapons on overall aircraft handling qualities. Specific performance study areas will include: 1. Incre-

mental drag coefficient, 2. Range degradation, and 3. Maximum speed degradation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

1.0006, VHF AVIONICS MODIFICATIONS
UNKNOWN, Bendix Corporation, *Fort Lauderdale, Florida* 33310 (TSC-1121; TS058757 (TRAIS NO.))

The joint AEROSAT program will provide a satellite capability: 1. to demonstrate that it will be possible to attain the quality of service expected in an operational phase for air traffic control (ATC) and air carrier purposes; 2. to evaluate the technical and operational performance of voice and data communication between ground and aircraft over various areas; 3. to permit experimental evaluation of dependent and independent surveillance capabilities, and of navigational data derived by an aircraft utilizing ground and satellite transmissions; 4. to contribute data to enable ECAO to develop its Standards and Recommended Practices (SARPS) for an operational capability; 5. to directly compare the performance of VHF and L-band aeronautical satellite systems for voice and data communications and surveillance.

SUPPORTED BY U.S. Dept. of Transportation, Research & Special Programs, Transportation Systems Center

1.0007, HOLOGRAPHY FOR CARRIER LANDING/LSO SIMULATION
A.H. RODEMANN, U.S. Navy, Physical Sciences Laboratory, *Orlando, Florida* 32813 (DN221024)

To develop a carrier landing trainer concept utilizing the three-dimensional storage and display characteristics of holography. The system will provide a visual display of an aircraft carrier from any position in space to be used by a pilot trainee located in a mock-up cockpit with controls and computer-fed aerodynamic simulation. Coupled with this system and operating in conjunction with it, will be a landing signal officer (LSO) station viewing a display of the aircraft coming down to the carrier. Interactions will be carried out between the pilot and LSO during the carrier landing operation.

This program will further develop the feasibility model of the holographic carrier landing simulator and will incorporate the LSO station into the system. Realistic horizon line, ship's wake, FLOLS (meat ball), carrier deck (for the LSO station) will be investigated for adaptation to the system. 360 deg holographic techniques will be utilized for the carrier and the aircraft in order to present the appropriate view to the two stations.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Training Equipment Center

1.0008, GENERALIZED VTOL SIMULATION MATHEMATICAL MODEL
W. YIH, U.S. Navy, Computer Laboratory, *Orlando, Florida* 32813 (DN594003)

The purpose of this task is to formulate a generalized VTOL math model (including engine model). The math model will then be simplified to a few VTOL aircraft models which have potential to be turned into production models. The model will be used to evaluate the dynamic response, handling quality and visual coupling of VTOL aircraft training devices. Other potential use of the model will be to study the interface problems with sea control ships under high speed and sea state, thereby improving pilots' landing technique.

NAVTRAEQUIPCEN technical reports 1205-2 and 6 will be used as references. The aerodynamic and engine data for specific VTOL aircraft will be purchased. The primary effort will emphasize simulating ground effect and transition flight. The models will be implemented on the Sigma 7 computer. Existing aircraft computer programs will be used as guides but will be extensively modified to accommodate variable configurations of VTOL aircraft.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Training Equipment Center

1.0009, STUDIES OF DYNAMIC STALL OF AIRFOILS FOR HELICOPTER ROTORS 12742-E
A.A. FEJER, Illinois Inst. of Technology, School of Engin. & Phys. Sci., *Chicago, Illinois* 60616 (DA0H5577; DAHC04-75-G-0142)

To study the quantitative description of the dynamic stall process for various values of advance ration, reduced frequency, mean value and amplitude of the angle of attack, and the Reynolds number on an oscillating airfoil in a periodically varying free stream. Relevance -this research is directly relevant to the dynamic stall studies in progress at the Ames and Langley Directorates of the AMRDL. In addition, experimental techniques developed in this proposal are also relevant to activities at the Ames Directorate of AMRDL.

The study will make use of two special IIT experimental facilities (a water tunnel and wind tunnel) that enable one to simulate concurrently the oscillations in angle of attack and in free stream velocity to which rotor blades are subjected.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

1.0010, NAVY VEHICLE DESIGN AND CONSTRUCTION - AEROELASTIC PHENOMENA IN THIN AIRFOIL CASCADES
S. FLEETER, General Motors Corporation, *Indianapolis, Indiana* 46206 (DN223542; N00014-72-C-0351)

Obtain fundmental experimental data on aeroelastic phenomena in thin airfoil cascades with the objective of developing improved analytical techniques, with increased range of validity, useful in the design and development of compact lightweight compressor components for advanced engine configurations. This research contributes to increased life and reliability of military aircraft engines with optimum performance by providing better design information for compressor components with minimum weight and volume.

The invesigation is aimed at acquisition of experimental data on various supersonic inlet cascades by use of a unique airfoil excitation system used to simulate time-dependent airfoil interactions, to provide periodicity and to control the interblade phase angle. Laser holography is used to determine vibrational characteristics at Mach numbers for which there are no aeroelastic data available. The data closely approximate conditions occurring in turbofan engines and are useful in correlations with analytical predictions obtained from modeling techniques.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0011, PERFORM FLIGHT TEST OF GUIDED DROGUE
UNKNOWN, Beech Aircraft Corporation, *Wichita, Kansas* 67206 (DN590182; N00019-76-C-0555)

To improve the state-of-the-art of aerial refueling capability under adverse weather conditions and to obtain greater assurance of successful engagement.

The contractor will design, manufacture and test the guided drogue.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0012, DEVELOPMENT OF A DATA BANK FOR ANALYSIS OF TEST RESULTS
UNKNOWN, Computer Sciences Corporation, *Silver Spring, Maryland* 20910 (FA77NA-4011/2; FA160260 (TRAIS NO.))

The Controller Performance Measurement (CPM) activity is engaged in adapting and applying measures derived from NAFEC's DSF to the evaluation of individual air traffic controller performance. Individuals will be compared and evaluated using the methods and techniques and measures developed in this activity as part of the evaluation which must be made of their performance while they are students at the FAA Academy. Two approaches are possible and have different desirabilities and features: (1) several measures are differentially weighted and combined into a single number and (2) all of the measures are

retained and transformed into normalized standard scores and then formed into a profile.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0013, FLIGHT PERFORMANCE OF DEPLOYABLE FABRIC WINGS
T.F. GOODRICK, U.S. Army, Natick Research & Dev. Command, *Natick, Massachusetts* 01760 (DA0G4226)

To analyze the factors necessary to achieve satisfactory flight performance of gliding decelerator systems used to airdrop troops and supplies under exceptional circumstances.

Various analytical techniques and some experimentation will be used to study the various aspects of gliding flight with flexible decelerators and the interrelations of the various aspects. In addition to steady flight characteristics, unsteady flight characteristics such as transition from opening to guided gliding path, response to control actuation, response to wind perturbation and performance of transient landing maneuvers will be studied.

SUPPORTED BY U.S. Dept. of Defense, Army, Natick Research & Development Command

1.0014, MATERIAL CHARACTERIZATION PROCEDURES FOR DESIGN OF PAVEMENTS
W.R. BARKER, U.S. Army, Waterways Experiment Station, *Vicksburg, Mississippi* 39180 (DA0L8185)

To develop methodology for characterizing the structural properties of various types of pavement materials and to formulate this methodology into definitive procedures that will yield quantitative parameters for design of road and airfield pavements using existing or newly developed theoretical and semitheoretical criteria.

A range of materials that are acceptable for use in the design of pavements will be considered. Various types of laboratory test procedures will be studied to determine methods of integrating the quantitative output of acceptable laboratory tests with conventional material acceptability standards such as gradation, plasticity, etc. Material characterization procedures will be developed to provide the user with direct and/or indirect methods of obtaining quantitative design parameters.

SUPPORTED BY U.S. Dept. of Defense, Office Chief of Engineers, Corps of Engineers

1.0015, EXPERIMENTAL EVALUATION OF NON-AXISYMMETRIC EXHAUST NOZZLES
P.E. HILEY, McDonnell Douglas Astro. Co., *St. Louis, Missouri* 63166 (DF136160; F33615-76-C-3019)

The relevant problem of this effort is the need to increase the range and/or decrease the fuel requirements of military aircraft plus a need for increased fighter aircraft maneuverability. The objective of this program is to experimentally investigate several non-axisymmetric exhaust nozzle concepts to determine what range improvement and/or maneuver enhancement may be obtained when the nozzles are designed into a particular airframe.

During the initial phase of the investigation selected non-axisymmetric exhaust nozzles will be designed, fabricated and statically tested to determine their relative static performance. These nozzles will then be installed in an isolated pod/wing arrangement and tested in a wind tunnel to determine their relative thrust minus drag performance and lift enhancement plus vectoring/reversal capability. The acquired data will then be used to estimate the performance (including maneuver capability) of aircraft that have the non-axisymmetric nozzles installed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0016, USE OF FROST SUSCEPTIBLE SOILS IN ROADS AND AIRFIELDS
N. SMITH, U.S. Army, Cold Reg. Res. & Engin. Lab., *Hanover, New Hampshire* 03755 (DA0K8146)

To develop design criteria and construction techniques for the construction and stabilization of MESL (membrane-encapsulated-soil-layers) roads and airfields in a winter environment. Results will be defined in terms of input to TM 5-337, TM 5-349, TM5-882-4, TM-5-300, and FM 31-71.

Maintain liaison with other Corps of Engineers laboratories, government agencies, universities and private industry. Conduct laboratory and field experiments on membranes, sealants, compaction, physical and chemical stabilization, frost susceptibility, freeze-thaw characteristics, and strength properties of fine-grained soils and 'dirty' gravels (high-silt and/or clay content gravels). Construct and test pavement sections under static and repetitive loadings when completely and partially frozen and completely thawed. Analyze surface deformation data from Benkelman beam and repetitive plate bearing (RPB) tests to determine in-site moduli of layered pavement systems for the above conditions. Monitor long-term performances of MESL test sections in seasonal frost and permafrost environments.

SUPPORTED BY U.S. Dept. of Defense, Office Chief of Engineers, Corps of Engineers

1.0017, DEVELOP AN MLS SERVICE TEST AND EVALUATION PROGRAM AS PROVIDED HEREIN
UNKNOWN, Tull Aviation Corporation, *Armonk, New York* 10504 (FA77WA-4034; FA160440 (TRAIS NO.))

The contractor shall study the initial requirements and objective of an MLS Service, Test and Evaluation (ST&E) Program, recommend revised requirements and objectives as may be appropriate and develop a detailed program plan to achieve these objectives. The effort will result in a report comprising the Contractor findings, conclusions, and a detailed plan for executing the recommended ST&E Program. The ST&E Program recommended by the Contractor hereunder shall be suitable for the test and evaluation of MLS equipment which meets the signal format requirements of ER-700-08A, hereafter referred to as MLS ST&E equipment.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0018, NAVY VEHICLE DESIGN AND CONSTRUCTION - UNSTEADY VISCOUS FLOWS
J.G. HALL, State University of New York, School of Engin. & Appl. Sci., *Buffalo, New York* 14214 (DN223404; N00014-76-C-0057)

Unsteady viscous flows which occur, for example, on aircraft wings during buffeting and stall, and in aircraft propulsion systems seriously affect performance throughout the speed range. Current viscous flow research has been overwhelmingly concerned with steady flows. It is the purpose of the proposed research to study, experimentally and theoretically, unsteady laminar and turbulent boundary layers over a broad range of Reynolds numbers in a tube-type wind tunnel at low speeds.

The use of a short-duration tube-type wind tunnel is a simple yet powerful method for the experimental study of unsteady viscous flows. An extremely reproducible viscous flow will be generated either on the walls of the tube or on a model supported in the tube. Though the flow will last for only milliseconds, it will be long enough for detailed measurements utilizing pressure and skin friction gages, resistance thermometers, pitot probes, and hot-film and hot-wire probes. Laminar and turbulent boundary layers will be studied with Reynolds numbers ranging up to full scale. Major emphasis will be devoted to the study of turbulent boundary layers, including comparisons of the experimental results with integral methods for prediction. The relaxation of the time-dependent flow to steady state will be followed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0019, MODULE DEVELOPMENT FOR THE STAGING SYSTEM
L.E. HULBERT, Battelle Memorial Institute, *Columbus, Ohio* 43201 (DF138240; F33615-76-C-3125)

The use of finite element methodology in the design of structural components contributes significantly to the effectiveness and efficiency of flight vehicles. There is a need to accelerate the

data handling requirements normally associated with using this methodology. The objective of this effort will be directed toward the enhancement of the Air Force staging system by providing new modules, postprocessing and materials data base, not yet developed, by enhancing the display and edit and the generalized data base modules already developed, and by providing a limited number of analysis modules for evaluation of the total system. These additional capabilities will provide necessary automation of many time-consuming tasks normally associated with using the finite-element methodology.

The postprocessing and material data base modules will be designed, coded and integrated into the staging system. Concurrent with this effort enhancements will be made to the display and edit module and generalized data base. Finally, selected existing analysis codes will be integrated into the staging system to evaluate the system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0020, HYDROCARBON FUEL RESEARCH IN AN ADVANCED AIRCRAFT FUEL SYSTEM SIMULATOR

R.P. BRADLEY, U.S. Air Force, Aeropropulsion Laboratory, *Dayton, Ohio* 45433 (DF451380)

Evaluate the overall performance and thermal stability limits of present operational and new candidate hydrocarbon jet fuels under simulated flight conditions to (1) determine the thermal limit and tolerance that these fuels provide when tested under various realistic flight profiles defined for aircraft systems under development and future aircraft, (2) examine the effect of various refining techniques, dissolved oxygen removal, and additives on fuel thermal stability, (3) provide a spectrum of fuel performance data that can be utilized by manufacturers in the design of engine and airframe systems, and (4) provide quantitative objectives to aid in the development of small-scale test methods.

The existing advanced aircraft fuel system simulator will be used as the primary test device. The thermal stability of fuels in various system components, e.g., tanks, oil coolers, manifold tubes, will be determined. JP-4 will also be evaluated to establish temperature limits of fuel. Parametric investigations of various modified versions of JP-type fuels and deoxygenated tests will be conducted. In addition, advanced fuel candidates will be evaluated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0021, HYDRAULIC DYNAMIC ANALYSIS EXPERIMENTAL VERIFICATION

P.D. LINDQUIST, U.S. Air Force, Aeropropulsion Laboratory, *Dayton, Ohio* 45433 (DF455370)

The purpose of this program will be to model the dynamic effects of an aircraft hydraulic system. Computer models will be developed and verified in the laboratory.

The approach will be to set up, beginning with a simple system, a hydraulic circuit in the laboratory and develop an analytic model which can be verified.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0022, DUCT ACOUSTICS RESEARCH

D.W. QUINN, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF138560)

To understand the dependence of sound levels within ducts upon such factors as duct geometry, sound-absorbing properties of the duct walls, type of sound source, and flow within the duct. Specifically, to develop new aero-acoustic models and solution techniques for general duct acoustics problems. This work will be a significant contribution to the AF Aero-propulsion Laboratory's efforts to reduce turbine engine noise levels. To quote RN-AFAPL-08-72-9, 'Current engine noise levels are hazardous to personnel and structures, detrimental to tactical operations and annoying to the general public.' Eventually we should be able to 'assess engine performance/noise trades' in the design of aircraft engines.

To handle variable-area ducts with no flow a method of conformal mapping in conjunction with a finite-difference method is used. As an alternative approach for the same problem an integral equation/potential theoretic method is appropriate. For the more general problem of variable-area ducts containing fairly general flows a finite-element method may be required. The acoustic equation for this general problem must be derived and an efficient numerical method must be implemented using local computer facilities.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0023, COMBUSTION SYSTEM REMOTE MEASUREMENTS

W.M. ROQUEMORE, U.S. Air Force, Aeropropulsion Laboratory, *Dayton, Ohio* 45433 (DF458220)

The objective of this program is to apply instrumentation which can measure temperature and specie concentration within chemically reactive zones of practical combustion devices.

A sophisticated Raman system to measure exhaust pollutants from an aircraft engine was developed on an AFAPL contract. It is now apparent that this system has many capabilities which can be utilized for combustion diagnostic purposes. For example, it can determine time-averaged temperature and specie concentration measurements, it has been hardened to operate in the adverse environment of a jet engine, Raman Stokes and anti-Stokes, MIE and Rayleigh scattering and fluorescence can be detected, and point measurements rather than integrated absorption methods can be accomplished. The approach is to apply this Raman system to a variety of different practical combustion problems. System capabilities and limitations will be determined in the following applications: exhaust plane temperature and species mapping, afterburner efficiency measurement, main-burner pattern factor measurement, and main-burner temperature and species mapping.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0024, ADVANCED CARBON BRAKES FOR FIGHTER AIRCRAFT

P. SKELE, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF140890)

This effort supports the development of design and performance criteria, and test techniques required for the optimum use of advanced carbon brakes on Air Force aircraft. Air Force aircraft incur high operational costs and down times due to maintenance and replacement costs of aircraft brakes. The objective of this program is to evaluate the potential of carbon-carbon composite materials used in aircraft brakes, and to develop standards and specifications for carbon brakes for future USAF aircraft. Potential advantages are lighter weight resulting in increased payload or lower fuel costs, better friction characteristics resulting in more efficient gear structure, and longer wear life resulting in lower acquisition and maintenance costs per landing and less down time.

A series of dynamometer tests will be conducted on three brake sizes (13 inch rim 2 rotor, 16 inch rim 4 rotor, and 18 inch rim 3 rotor) to evaluate the performance characteristics of carbon materials in aircraft brakes. A total of 8 carbon brakes with construction and material variations will be tested, along with two beryllium and one steel brake in order that the carbon performance may be assessed by comparison with more conventional materials. Brake performance will be evaluated as a function of energy level, rate of energy input, brake temperature, and brake wear rate. Additional sizes and carbon material variations shall be included in the test program as they are developed and become candidates for current and future aircraft.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0025, DEVELOPMENT AND DEMONSTRATION OF REMOTELY PILOTED VEHICLE AIR CUSHION LANDING SYSTEM

J.T. STEIGER, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF133460)

Present methods used to launch and recover remotely piloted vehicles (RPV) are expensive, and limit operational self-sufficiency, flexibility and mobility of these aircraft. The objective of this work unit is to accomplish in-house development and evaluation for an RPV air cushion landing system (ACLS) and to plan, evaluate and integrate RPV ACLS work accomplished under other AFFDL work units and by others. The development of an RPV ACLS will result in reducing RPV recovery costs by up to 90 percent and turnaround time by up to 80 percent. In addition, a new dimension will be provided for RPV operational flexibility and mobility by allowing launch and recovery to be accomplished on any relatively smooth, natural surface including water.

Under this work unit the overall planning, control and correlation of various separate and in-house accomplished RPV ACLS development and demonstration efforts will be accomplished. The primary area of work to be pursued is the successful ground, wind tunnel and flight testing of an AFFDL-developed ACLS on an Australian Jindivik Drone. Other efforts will be aimed at increasing ACLS technology and initial hardware development for an RPV ACLS. Work results will be rapidly transferred to the RPV SPO, other Air Force and government organizations and industry to speed the use of ACLS on RPV aircraft. Individual AFFDL technical memos will be prepared as individual in-house tasks are completed. A final technical report will cover all in-house work and work by others accomplished during the time-frame of Jindivik ACLS flight test and evaluation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0026, AERODYNAMIC PREDICTIONS FOR ANALYSIS AND DESIGN

T.M. WEEKS, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF131990)

Aerodynamic prediction methods for analysis and design are required throughout the subsonic, transonic, and supersonic speed range of advanced technology military aircraft. The objective is to obtain for in-house use both quick-turnaround programs (level I) and more comprehensive programs providing much greater accuracy (level II). Computer programs for handling arbitrary configurations will be obtained and appropriate theoretical and experimental investigation will insure their validity. These programs are necessary to prevent technological deficiencies and reduce development cost.

Existing level I programs will be extended to handle advanced technology concepts. Capabilities of current level II programs will be identified, obtained/extended where possible and new programs developed. Analytical efforts and experimental investigations will provide validation of key features of computer programs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0027, AIRCRAFT LINEAR AND ANGULAR VIBRATION PREDICTION

P.W. WHALEY, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF136760)

Due to the inadequacy of present prediction techniques for aircraft vibration environments, many complex and expensive avionics and weapons systems are unreliable or overdesigned. The performance of electrooptical and inertial sensing systems is dependent on angular as well as linear vibration, but very little is known about this environment. Present vibration prediction methods will be improved with an empirical prediction technique for the vibration induced by the noise environment of fighter aircraft and the vibration transmission paths to internal equipment mounting locations. A compendium of angular vibration data from flight tests on fighter, transport, and bomber aircraft will be produced, and these data used to formulate an empirical prediction technique for angular vibration.

This effort will be approached in two phases. First, external acoustic excitation will be correlated with acceleration response at equipment mounting locations in an RF-4C at several flight conditions. Statistical regression analysis will be conducted on the flight test data to relate responses and excitations, and confidence intervals about the regression lines will be established. Concurrently, angular vibration measurements will be made on the RF-4C and other types of aircraft to provide a compendium of angular vibration data. Since angular vibration transducers for these measurements are not readily available, the second phase will begin with a comprehensive investigation into angular transducers and their calibration techniques. An empirical prediction technique will be developed from the flight data with special emphasis on relating angular and linear vibration.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0028, AERODYNAMIC PROPERTIES OF EJECTING CREWMAN

B.J. WHITE, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF140240)

To increase the probability of crewmember survivability during in-flight emergencies through providing more effective emergency escape subsystems. Solutions will be identified for the current operational problem of a high incidence of aircrew injuries due to limb flailing. Aerodynamic forces acting on the crewman during ejection from aircraft flying at transonic and supersonic speeds will be determined. Design criteria will be established to form a basis for concept assessment and equipment designs to provide crew protection during emergency escape from high-speed combat aircraft.

High-speed wind tunnel tests will be conducted using special seat/man models to provide limb flail force as well as basic aerodynamic data. Existing limb-restraint concepts and hardware will be assessed and concepts formulated to provide a solution to the limb-flail injury problem. The effort will be accomplished jointly with the 6750th Aerospace Medical Research Laboratory.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0029, TRANSONIC MUTUAL INTERFERENCE AERODYNAMICS

D.R. CHAUDHURI, Univ. of Tennessee, Space Institute, *Tullahoma, Tennessee* 37388 (DF641420; F08635-77-C-0098)

This work unit will support store separation analysis. The major area to be addressed by this work unit is the analytical prediction of aerodynamic forces under transonic conditions. The goal of this work unit is to develop an analytical technique capable of predicting the aerodynamic forces acting on a store during carriage and release from an aircraft flying at transonic speeds. The technique developed by this work unit will decrease the cost of determining the store/aircraft aerodynamic compatibility.

The principal investigator shall perform basic research in the field of theoretical transonic aerodynamics applicable to aircraft/store interference analysis. He shall adapt current state-of-the-art single-body transonic aerodynamic theories and techniques to the multi-body mutual interference problem. The bodies to be considered are a single slender pointed body of revolution store, a thin swept wing, and a slender pointed body of revolution fuselage.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

1.0030, POWERED LIFT AERODYNAMICS

R.G. BRADLEY, General Dynamics Corporation, *Fort Worth, Texas* 76101 (DF134230; F33615-75-C-3033)

Recent studies of advanced fighter aircraft have indicated that significant transonic maneuver performance gains may be possible through a combination of vectored thrust and wing leading edge vortex augmentation. The objective of this effort is to experimentally investigate this combined blowing approach. The basic idea of this concept is to locate the engine exhaust nozzle over the wing and ahead of the trailing edge. A jet flap effect is

achieved by turning the exhaust flow over a trailing edge flap. Vortex augmentation is combined with this effect by vectoring a portion of the engine efflux spanwise.

Tests will be conducted in the NASA/LARC 7 x 10 ft, low speed, 16 ft transonic, and V/STOL wind tunnels and in the AEDC 16 ft, transonic wind tunnel using a contractor-owned model. Lift, drag and pitching moment data will be taken for a range of angles of attack from minus 4 degrees to the maximum obtainable and for Mach numbers ranging from 0.2 to 1.2. Systematic variations in propulsion system geometric and flow parameters will be made to determine the effects on measured aerodynamic forces. The parameters to be investigated will be typical of actual engine operating conditions and will include a nozzle pressure ratio range from 1 to, nominally, 6, with jet momentum coefficients ranging from 0 to 0.2 at 0.9 Mach number. The experimental data will be analyzed to verify the aerodynamic/propulsion benefits of this powered lift concept and to provide a technology data base from which vehicle applications can evolve. In addition, the contractor-derived semiempirical prediction methodology will incorporate the comma jet flap data to improve the lift, drag, and moment prediction capability. The jet flap data will be obtained from the AFFDL comma wind tunnel test conducted in the NASA/Ames 14 ft tunnel during Jan 75.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0031, THE IMPORTANCE OF PROVIDING STEREOSCOPIC VISION IN TRAINING FOR NAP-OF-THE-EARTH FLIGHT
D.E. ERWIN, U.S. Army, Res. Inst. for The Behv. & Sci, *Alexandria, Virginia* 22314 (DA644182)

The Army has begun to design, develop, and procure flight simulators for the Cobra attack helicopter. The rationale for this rather significant investment is that flight simulators are both cost-and training-effective. The cost-effectiveness of flight simulation is unquestionable. Training effectiveness isnot, unfortunately, as clear-cut a matter. The visual display in simulators currently being procured is bioptic--essentially that seen if the air space were monitored with one eye. This means that the pilot-trainee learns the demanding perceptual/motor coordination required for successful nap-of-the-earth (NOE) flight with only a subset of the cues for depth perception normally available in the 'two eyed' world. Considering the criticality of highly proficient obstacle avoidance ability for safe and tactically acceptable NOE flight, the Army cannot afford to train to minimally proficient performance.

The research program will seek to determine the criticality of stereoscopic cues for depth perception to high-proficiency NOE flight, and will provide a recommendation regarding either design changes, or new training strategies to insure the development of maximally efficient depth perception in pilots required to fly NOE.

SUPPORTED BY U.S. Dept. of Defense, Army, Research Inst. for the Behavioral & Social Sciences

1.0032, SECURITY SYSTEMS ANALYSIS
UNKNOWN, Inst. for Defense Analysis, *Arlington, Virginia* 22202 (FA77WA-3974; FA160074 (TRAIS NO.))

The objective is to perform a security systems analysis to insure that the equipment selected under the Civil Aviation Security R&D Program and procedures will detect weapons and explosives effectively. As part of this effort, the contractor will determine whether total costs to the airlines and airport operators are appropriate to the level of explosive threat and whether the weapon and explosive detection systems are currently being developed by or for the FAA are compatible with commercial aviation operations.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0033, INTEGRATED PROPULSION CONTROL SYSTEMS
G.W. LAMPARD, Boeing Company, *Seattle, Washington* 98108 (DF455710; F33615-73-C-2035)

The objective of this program is to develop and demonstrate in flight an integrated propulsion control system (IPCS) which will automatically regulate all the functions of an inlet engine exhaust nozzle system. Particular attention will be given to maintaining adequate stability margins in the face of maneuver-induced instabilities.

A multiple source contracted effort is planned with use being made of NASA's Lewis Research Center altitude facilities and NASA FRC flight test facilities. The IPCS will be designed, fabricated and flight tested on an F-111 E aircraft.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0034, AIRPORT AND COMMUNITY NOISE DATA
UNKNOWN, U.S. Small Business Admin., *Seattle, Washington* 98104 (FA77WAI-723; FA59968 (TRAIS NO.))

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, INVESTIGATION OF ELECTROCHROMIC DIPHTHALOCYANINES
M.M. NICHOLSON, Rockwell International Corp., *Anaheim, California* 92803 (DF048120; F49620-77-C-0074)

AF function - future Air Force operations require improved electrooptical and electronic materials for use in flight control, reconnaissance and surveillance, and signal processing and control devices. Deficiency - a need exists for new materials which can be exploited for the design of new concepts and classes of electrooptical devices. Objective - the objective is to determine mechanisms and rate parameters for electrochromic transformations in rare-earth diphthalocyanine complexes. How work contributes - the research will provide a new class of electrooptical materials which may find applications in visual displays, large-array memories, and other electronic devices.

The mechanisms and rate parameters for electrochromic transformations in rare-earth diphthalocyanines will be determined. The methods of investigation will include in situ spectroelectrochemical measurements, thin-layer electrochemistry, and charge-carrier injection techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0002, DEFLAGRATION TO DETONATION TRANSITION IN HMX-BASED PROPELLANTS
M. COWPERTHWAITE, S R I International, *Menlo Park, California* 94025 (DF047220; F49620-77-C-0039)

AF function - many of the energetic propellants required for present and future Air Force long-range delivery systems are explosively filled compositions that are capable of undergoing deflagration to detonation transition (DDT). Deficiency - the mechanism of DDT and the conditions for its initiation are not well understood. Objective - this research will develop a computational capability for assessing the DDT hazard in explosively filled propellants. How work contributes -establishing the conditions for the onset and building of DDT will safeguard against the destruction of the missile and the launching platform by detonation of the rocket motor.

Experimental and theoretical studies on hmx-based propellants will be made in order to obtain a fundamental understanding of DDT and formulate a satisfactory model for its description. In the experimental studies, ionization gages and multiple LaGrange stress gages will be used to measure flame speeds and the pressure fields ahead of the flame in propellants with and without a simulated crack field. These measurements will serve to determine conditions for the onset of DDT and elucidate its mechanism. The first task of theoretical study will be to formulate a physically realistic model for the flow produced by an unsteady flame. The results of the experimental studies will then be incorporated into

the treatment of the unsteady flame to generate a satisfactory model for DDT.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0003, PROPERTIES OF NEW SUPERCONDUCTING MATERIALS

T.H. GEBALLE, Stanford University, School of Engineering, *Palo Alto, California* 94305 (DF035580; AF-AFOSR-2435-73)

AF function - high-temperature superconducting materials are needed for application in airborne multimegawatt power generation and conditioning systems. Opportunity - research specifically directed toward the synthesis and characterization of high transition temperature metallic compounds can provide a greater margin of design efficiency and operational reliability than presently available superconductors. Objective - this research is concerned with the synthesis and study of the properties of new and unusual superconductors. Interactions giving rise to superconductivity are being studied in order to find new high transition temperature superconductors. How work contributes - the performance of high field magnets and solenoids, electric motor windings, superconducting rotors in power generators, transformers and induction energy storage systems could be significantly improved if the upper critical field, the current-carrying capacity and the critical transition temperature of the superconducting material could be enhanced.

Metastable phase equilibria at lower temperatures are being studied by utilizing the unique capability of the electron-beam codeposition apparatus to lay down intimate mixtures of two or more components on a substrate whose temperature is subject to independent control. The high superconducting transition temperature A-15 phases are being investigated. Particular attention is given to Nb3Ge, Nb3Si, and ternary compounds derived from them. The superconducting properties are being correlated with the new phases using sensitive thermal and electrical techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0004, A FUNDAMENTAL STUDY OF THE PROCESSING OF OXIDE DISPERSION-STRENGTHENED METALS

W.D. NIX, Stanford University, School of Engineering, *Palo Alto, California* 94305 (DF046250; AF-AFOSR-3128-77)

AF function - the demanding requirements of high-performance aerospace vehicles make clear the need for materials with premium mechanical properties. Dispersion-strengthened alloys are being used in the hottest sections of some high-performance gas turbine engines and their use is expected to become even more widespread in aerospace systems of the future. Opportunity - with the recent discovery and development of mechanical alloying, it is now possible to dispersion-strengthen virtually any alloy of interest. Objective - this research will determine the mechanical alloying and deformation processing factors that are most important in producing homogeneous oxide dispersions together with elongated grain structures. How work contributes - this information is required to develop sufficient understanding of the mechanisms responsible for elongated grain structures that guidelines might be written for producing these desirable microstructures in oxide dispersion strengthened superalloys of interest to the Air Force.

A fundamental investigation will be undertaken to determine the effects of oxide content, and thermal and mechanical history on the shapes and crystallographic orientations of recrystallized grains in various particle-strengthened alloys (both model systems and Ni-Cr-Al systems).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0005, NAVY VEHICLE DESIGN AND CONSTRUCTION - MECHANICAL BEHAVIOR OF TITANIUM ALLOYS

N.E. PATON, Rockwell International Corp., *Thousand Oaks, California* 91320 (DN675316; N00014-76-C-0598)

Titanium is an important structural material for use in aircraft and ships. Microstructure as controlled by processing affects the properties of titanium and these ultimate applications. This research effort will be directed towards improving the toughness of titanium by modifying the microstructure.

The research is divided into two phases. Phase I examines the structure and properties of annealed titanium 6-4. In particular, formation of the interface phases present at alpha-beta interfaces under certain processing conditions will be studied for any effects on strength and toughness. The kinetics of formation and crystallography of the interface phases will be determined. In phase II the effects of hydrogen on elastic modulus and strength of beta titanium alloys will be explored. Model alloys and commercial beta III will be included in the program.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0006, ANALYSIS AND DESIGN OF COMPOSITE BONDED JOINTS UNDER A DYNAMIC TYPE LOAD

J.R. VINSON, Univ. of Delaware, School of Engineering, *Newark, Delaware* 19711 (DF027060; AF-AFOSR-2739-74)

AF function - advanced aerospace vehicle designs require improved structural efficiency to meet mission objectives and improved durability to reduce Air Force ownership costs. Opportunity - advanced composite materials for primary structure and adhesive bonding represent significant new opportunities to enhance Air Force structures in functions indicated above. Objective - the objective of this research is to experimentally study the fatigue behavior of composite adhesively bonded joints and identify the failure mechanisms and governing parameters. How work contributes - this research contributes to the technology base associated with composite structural development for aerospace vehicles.

Approach being followed by this research is primarily experimental. Single lap joints of graphite epoxy will be statically and fatigue tested. Tests will include environmental exposure to both moisture and temperature in order to study degradation of both composite adherends and adhesive. In particular, changes in failure mechanisms which can occur as a result of environment will be sought. Load-frequency effects will also be studied through experimentation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0007, EVALUATION OF CHEMICAL RESEARCH RELEVANT TO CURRENT AND PROJECTED U S AIR FORCE INTERESTS

J.E. EARLEY, Georgetown University, School of Arts & Sciences, *Washington, District of Columbia* 20007 (DF039870; F44620-75-C-0001)

AF function - flight operations, communications, and logistics rely on superiority in the materials, propulsion, and avionics technologies. Deficiency - advances in the technologies need long lead time discoveries in scientific chemical research. Objective - this effort provides in-depth expert scientific evaluation of proposed research programs in the field of chemistry. How work contributes - the results of the evaluations contribute to the selection of chemical proposals of the highest scientific merit. This, coupled with the scientific and relevance assessments made by AFOSR scientists, makes up the highly competitive and balanced selection procedure.

This effort provides the means for in-depth scientific evaluation of chemical research proposals by leading scientists in the nation. The panel is made up of fourteen experts from the academic, industrial, and governmental chemical science communities. Activities typically include two meetings of the panel each year, the in-depth review of selected research proposals, and other expert consultation, as requested. The determination of Air Force relevance, the in-house scientific review, along with the in-depth scientific review by the evaluation panel, insures the selection of high-quality research for inclusion in the AFOSR, Directorate of Chemical Sciences' program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0008, RELATIONSHIP BETWEEN MICROSTRUCTURE AND MECHANICAL PROPERTIES OF INTERMETALLICS
J.J. HREN, State University of Fla. Sys., School of Engineering, *Gainesville, Florida* 32611 (DF047770; AF-AFOSR-3254-77)

AF function - requirements for gas turbine engines include strong, lightweight, oxidation resistant materials for high-temperature operation. A need exists for materials to operate at higher engine temperatures (to improve operating efficiency), and for lighter weight materials (to decrease engine weight, engine operating stresses due to heavy components, and fuel consumption). The needed materials must have the same density as titanium combined with the mechanical properties and oxidation resistance of nickel-base superalloy. Opportunity -intermetallic compounds in general, and the titanium aluminides in particular, have exhibited great potential for such applications. Unfortunately, nearly all intermetallic compounds are brittle at low temperatures, making their fabrication difficult and presenting potential hazards in service. However, recent reports indicate that some alloying additions can substantially improve low-temperature ductility. Objective - this research will determine the intrinsic mechanisms of deformation and the available means for their control in a wide class of intermetallic compounds. How work contributes - initially, the investigation will be directed towards clarifying the source of improved ductility in the titanium aluminides.

The research will involve fabrication, testing, and detailed microstructural analysis of a range of alloys. Prime goals will be to deduce the microstructural sources of these beneficial effects and to discover guidelines for more general application. The strength of these studies is founded on the use of advanced electron metallographic techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0009, FLOW AND FRACTURE PROCESSES IN POWDER METALLURGICAL NICKEL-BASE SUPERALLOYS
M.J. BLACKBURN, United Technologies Corp., *West Palm Beach, Florida* 33402 (DF047550; F49620-77-C-0083)

AF function - nickel-base superalloys, because of their unique high-temperature properties, find extensive application in the turbine section of gas turbine engines. Opportunity - as the performance requirements of such aerospace power plants become more demanding, the material properties must be improved to compensate for the more severe operating conditions. However, the specific property improvements required in an alloy depend upon the component for which it is to be used. For the airfoil section of a blade, high-temperature creep and rupture properties coupled with good thermal fatigue resistance are critical properties. For a turbine disk, which operates at lower temperature, improved engine performance translates into requirements for higher strength materials with superior stress rupture characteristics. Objective - this research will obtain insight into the factors and mechanisms that control the strength and stress-rupture properties of powder metallurgy nickel-base superalloy disks fabricated by hot isostatic pressing. How work contributes - as such, it will contribute to AF programs to exploit advanced cost-effective manufacturing methods (hot isostatic pressing of nickel alloy powders) for the production of critical engine components.

Two basic mechanical properties of nickel-base superalloys fabricated by powder metallurgy techniques have been selected for study - stress rupture, and strength with emphasis on the yield stress. Several alloy compositions, including MERL-76, will be selected for detailed mechanical and microstructural characterization. Quantitative models will be constructed of the mechanical processes, and related to experimental observations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0010, SPECTRAL AND TOTAL EMISSIVITY AND REFLECTIVITY AT HIGH TEMPERATURES
R.E. TAYLOR, Purdue University, School of Engineering, *Lafayette, Indiana* 47907 (DF047910; AF-AFOSR-3280-77)

AF function - weapons delivery. Deficiency - development of laser-hardened materials for aircraft surfaces and system components is hampered by lack of high-temperature data on thermophysical properties of most solids of possible interest. Objective - to obtain reliable experimental values of emissivity and reflectance as functions of wavelength (1 to 12 micrometers) and temperatures (800 to 1800K) for selected key metallic and nonmetallic materials. How work contributes -provides needed data for evaluation of candidate development materials, and will result in predictive methods for higher temperatures and related substances.

During the second year of this research the high-temperature emissometer will be used to measure (1) emissivity in vacuum of carbides and nitrides of boron and silicon as a function of wavelength and temperature, as standard reference data, (2) emissivity of selected materials in the atmosphere compared with vacuum, and (3) the effect of rapid (up to 50K per second) temperature rises on emissivity in the atmosphere. Necessary modification of the apparatus for the latter purpose will be made.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0011, EVALUATION OF BINDERS FOR PROPELLANTS
D.M. FRENCH, U.S. Navy, Propellant Science Department, *Silver Spring, Maryland* 20910 (DN485184)

Improve reliability and service life of Navy rocket propellant systems by establishing relationships between chemical structure of polymers and performance of solid propellants employing these polymers as binders. Develop meaningful specifications to enable competitive procurement of propellant binders and reduction in Navy costs.

The approach includes determination of the chemical structure of selected polymers, development and standardization of new analytical techniques to determine such parameters as molecular weight distribution and functionality. Development of statistical correlations between binder characteristics and propellant properties and development of specifications based on these studies for procurement of polymers.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Sea Systems Command

3.0012, DEVELOPMENT OF KEVLAR-29 DECELERATOR SYSTEMS MATERIALS
N.J. ABBOTT, Fabric Research Labs. Inc., *Dedham, Massachusetts* 02026 (DF139500; F33615-77-C-3007)

Deployable aerodynamic decelerator systems are germane to the accomplishment of many military missions. These systems are employed to decelerate, recover and/or position payloads in a wide spectrum including small electronic countermeasure devices, escaping aircrew members, weapons and entire aircraft. Evolution of decelerator system requirements has resulted in the necessity to increase effective performance per unit of decelerator system weight and volume. Yarns of Kevlar-29, an aeromatic polyamide fiber currently in limited production, have been used in fabricating experimental decelerators which have exhibited up to fifty percent weight and volume savings over similar-strength nylon decelerators while demonstrating comparable performance. The objective of this work unit is to develop a spectrum of Kevlar-29 textile materials from which decelerator system components can be designed, to ascertain the mechanical properties of these materials and to generate specifications for each material. Specifications for a spectrum of Kevlar-29 textile materials will provide decelerator system designers with the capability to reduce weight and volume requirements. These reductions allow increased mission effectiveness in the forms of longer range, reduced fuel costs, and wider and more effective decelerator system applications.

For each specified material strength, type and dimension, braiding or weaving technique and yarn configuration combinations will be chosen based on previous experience. These combinations will be utilized to produce small quantities of material which will be tested to determine relative properties to be used in optimizing the material. Testing of the optimized material will be accomplished to reveal detailed material properties, seamability and suitability. As more materials evolve and experience in Kevlar weaving and braiding accrues, previous material specifications will be updated as necessary to incorporate findings.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

3.0013, MATERIALS FOR HELICOPTER SEATS
D.J. PAPETTI, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0F4705)

To investigate optimum armor systems using electroslag remelted (ESR) steel as the principal impact surface. The armor protection will be directed to aircrew safety with particular emphasis on armored helicopter seats. Thrust - survivability.

The approach will include investigating various systems, all of which will involve ESR steel as the impact material in a monolithic configuration and as the front face of a composite system. The ESR steel will be hardened to high hardness levels and evaluated at various thicknesses and in composite form with various backface materials including aluminum, woven roving, Kevlar, etc. The various systems will be ballistically evaluated against various projectiles including cal .30 AP and cal .50 AP.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0014, BETA SILICON NITRIDE SOLID SOLUTIONS CONTAINING METAL OXIDES
T.Y. TIEN, Univ. of Michigan, School of Engineering, *Ann Arbor, Michigan* 48106 (DF044550; AF-AFOSR-3078-76)

AF function - high-performance, economical turbine engines are required for remotely piloted vehicles (RPV) and auxiliary power units (APU). Opportunity - ceramic materials offer great advantages over refractory metals if high-strength, fully-dense components can be mass produced. Objective - this work seeks to establish the parameters affecting full densification of ceramic materials through a thorough knowledge of the phase equilibria, crystal structure and reaction paths involved. How work contributes - full densification of this material is required in order to maximize strength and minimize corrosive degradation in severe turbine environments.

Thermodynamic phase equilibria will be determined in selected beta silicon nitride-metal oxide systems and applied to the fabrication of articles by the pressureless sintering methods. Various starting materials will be examined in order to take advantage of the most advantageous reaction path.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0015, PHYSICAL/CHEMICAL PROCESSES CONTROLLING LOW-ALTITUDE ROCKET EXHAUST PLUME VISIBILITY
H.S. PERGAMENT, Aerochem Research Labs. Inc., *Princeton, New Jersey* 08540 (DF046690; F49620-77-C-0016)

AF function - future tactical rockets will require reduced smoke or totally smokeless propellants. Deficiency - the fundamental physical and chemical processes that describe the distribution of both primary and secondary smoke particulates in rocket exhausts are not well understood. Objective - this effort will employ a systematic analysis to reveal the dominant processes that contribute to visible plume signatures under realistic atmospheric and flight conditions. How work contributes - will permit more efficient and cost-effective design of low-signature rockets for a wide range of combat scenarios.

A two-phase nozzle transonic flow solution will be incorporated into the Aerochem Fullnoz code. The distribution of inert primary smoke particles will be calculated. Particle diffusion will be treated by accounting for turbulence coupling. The sensitivity of primary smoke properties to uncertainties in particle sizes and drag/heat transfer coefficients will be investigated. The importance of accurately accounting for particle/turbulence coupling on the motion of inert primary smoke particles in the plume will be determined. Based on the results of these numerical experiments, the processes controlling the distribution of primary smoke particle concentrations will be determined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0016, FATE OF SELECTED AIR FORCE PROPELLANTS AND LUBRICANT ADDITIVES IN THE AQUATIC ENVIRONMENT
H.C. SIKKA, Syracuse Research Corporation, *Syracuse, New York* 13210 (DF046860; F49620-77-C-0027)

AF function - a number of chemicals including missile propellant and lubricant additives are widely used in Air Force operations. These are introduced into the aquatic environment through routine operations, spills, and waste-discharge effluents, and are of concern due to their potential toxicity. They may affect man through the drinking water supply, accumulate in the food chain, or be converted to other products with even greater toxicity. Deficiency - little information is available on the environmental fate of Air Force missile propellants and lubricant additives. Objective - this research will address the environmental fate of selected Air Force chemicals to evaluate the hazards associated with their release. How research contributes - results of this study should provide information needed to establish guidelines regarding discharge of Air Force products into water systems subject to state and federal regulations. This research directly supports subarea 1.9 'environmental protection' and RO 1.9.1 'health effects'.

The study will investigate the degradation of UDMH and PNA in naturally occurring aquatic communities, identify the resulting products, determine sorption and disorption of the chemicals in lake sediment, examine uptake and transformation by phytoplankton and determine uptake and metabolism by fish.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0017, DEVELOPMENT OF COMPOSITE MATERIAL UPPER DRAG BRACE FOR F-15 AIRCRAFT
M.J. BIEBER, Cleveland Pneumatic Company, *Cleveland, Ohio* (DF135650; F33615-75-C-3152)

Fatigue and corrosion are a major cause of landing gear hardware failure resulting in high landing gear life-cycle costs. The objective of this work unit is to develop a graphite epoxy drag brace suitable to replace the titanium upper drag brace on the F-15 main landing gear. This graphite epoxy hardware will be approximately 30 percent cheaper, weigh 40 percent less than the production hardware and be virtually free from the fatigue and corrosion problems experienced by conventional landing gear hardware.

The work to be done will be based on the successful AFFDL development of a small drag brace for an A37B aircraft and other composite landing gear hardware developed by the AFFDL. The F-15 composite drag brace will be designed, fabricated and tested to the current static and fatigue load requirements of the corresponding production hardware. Initial acquisition costs for a production quantity of 200 will be determined and cost savings established over the current titanium component.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

3.0018, COMPUTATIONAL STUDY OF CHEMICAL REACTION DYNAMICS AT THE GAS-SOLID INTERFACE
G. WOLKEN, Battelle Memorial Institute, *Columbus, Ohio* 43201 (DF046010; F49620-77-C-0004)

AF function - this proposed research primarily falls in the 6.3 research objectives which deal with the development of high-energy lasers. The specific problem under consideration will be the dynamics of reactions occurring at the gas-solid interface. A novel pumping mechanism for infrared lasers could result from this study, and the subsequent developments and refinements will have important technological consequences. Deficiency - in the development of any laser the main step is to achieve the correct population inversion of the system. With the large variety of possible gas-solid interactions (including various crystal faces and alloys), a preliminary computer screening to identify necessary characteristics for population inversion is needed to provide valuable guidelines for experimentation. Objective - the objectives involve development of a reasonable dynamical model for heterogeneous chemical reactions. Classical trajectories will be used to estimate the dynamics of a variety of chemical reactions occurring with a variety of interaction potentials. Such trajectory calculations can elucidate the energy requirements for another-

mic reactions. It is expected to establish the final state distribution of heterogeneous reaction products and under what conditions potentially useful population inversion occurs. Contribution - this research is a part of a comprehensive program in statistical mechanics.

The method proposed is to generalize the London-Eyring-Polanyi-Sato (LEPS) approach to molecular electronic energy calculations so that it describes the presence of the solid. In common with the LEPS technique, the correct asymptotic states are automatically built in. Since the LEPS interaction potential is quite flexible, a wide variety of qualitatively and quantitatively different potentials can be investigated. By simply varying a single parameter one can generate an interaction potential leading to exclusively atomic adsorption or molecular adsorption with various activation barriers at various positions in phase space. Thus extensive classical trajectory studies for a variety of such interaction potentials to ascertain what features of the potential most sensitively affect the dynamics of the reaction. Particular attention will be given to the final state distribution of the products with a view towards predicting which circumstance lead to useful population inversions in these heterogeneous systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0019, SURFACE ENERGIES AND RELATED PROPERTIES OF B-TITANIUM ALLOYS

R. SPEISER, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (DF040460; AF-AFOSR-2799-75)

AF function - materials having better strength-to-weight ratios, high toughness and improved resistance to corrosion are being sought for aircraft and space vehicles structures. Opportunity - improvement in these properties depends a great deal on the surface and grain boundary energetics of alloys. Objective and how work contributes - this research will obtain surface and grain boundary energy data that will contribute directly to the understanding of the mechanical behavior of a class of alloys, beta titanium, that is of current Air Force interest for improved airframe structures.

The high-temperature in-situ zero-creep method and grain boundary grooving technique will be applied to study Ti, Mo, V, and Ti-25 Mo and Ti-50V base alloys. The surface, grain boundary, twinning and stacking fault energies thus derived will aid alloy design to optimize mechanical and environmental resistant properties.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0020, RETAINED AUSTENITE & HYDROGEN DISTRIBUTION ON RATE-CONTROLLING MECHANISM OF HYDROGEN EMBRITTLEMENT IN HIGH-STRENGTH BCC STEEL

W.E. WOOD, Oregon Grad. Ctr., Graduate School, *Beaverton, Oregon* 97005 (DA0E9220; DAAG29 76 G0317)

To investigate the possibility of utilizing retained austenite in high-strength, low-alloy martensitic steels as a site for permanently trapping hydrogen. Relevance - This investigation is relevant to problems of hydrogen-assisted cracking of structural steels utilized in helicopters, armor, personnel vehicles and various field support equipment.

For AISI 4340 steel, examination of relative effects of grain size, carbide precipitation, and amounts of retained austenite will be compared to ascertain their relative roles in hydrogen embrittlement. The stabilization of retained austenite without large grain growth by silicon additions (2-3 percent) will be investigated. Direct observation of the transformation of retained austenite to martensite (loss of hydrogen traps) will be carried out. Quantitative analysis of the trapping ability of retained austenite will be made by determination of the actual hydrogen distribution and content of test specimens, and the amount of hydrogen trapped by retained austenite as a function of retained austenite and hydrogen present.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0021, THE INFLUENCE OF HOLD TIMES ON FATIGUE CRACK GROWTH OF ALUMINUM ALLOYS

H.L. MARCUS, Univ. of Texas, School of Engineering, *Austin, Texas* 78712 (DF042770; AF-AFOSR-2955-76)

AF function - the longevity, reliability and life-cycle costs of aerospace structures are related to the fatigue properties of the structural materials used. In fact, the fatigue properties of structural materials often limit their application, as well as the performance of the system in which they are incorporated. Thus, it is important to understand the mechanism of fatigue. Opportunity - one of the areas in fatigue crack propagation that has not been investigated in any depth is the influence long hold times under stress have on subsequent fatigue crack growth. This information on the relaxation behavior at the crack tip is vital since the general testing techniques in evaluating materials and structures use accelerated time schedules and are not representative of normal operation of a system. Objective - this research will establish how crack tip relaxation effects, resulting from long hold times, will influence subsequent fatigue crack propagation in aluminum alloys. How work contributes - understanding the relationship between accelerated and real time fatigue crack growth behavior is particularly important if mechanisms such as retardation of fatigue crack growth are to be related to design parameters.

The relaxation studies will be performed on 2000 and 7000 series aluminum alloy samples to which simulated cyclic stress-strain damage has been done, and the data correlated with direct measurements at the crack tip of compact tension and center-crack specimens. The influence of a variety of loading conditions and changes in microstructures will be studied to establish the important metallurgical variables involved.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0022, TIME-DEPENDENT FRACTURE OF PARTICULATE COMPOSITE MATERIAL

R.A. SCHAPERY, Texas A & M University System, School of Engineering, *College Station, Texas* 77843 (DF038910; AF-AFOSR-2697-74)

AF function - missile systems using solid propellants must have improved reliability and durability of material fracture behavior. Deficiency - a unified fracture theory for composite viscoelastic materials is needed which encompasses prediction of both fracture initiation and propagation. Results from this research project will improve the state of knowledge with respect to the service life predictability for propulsion and power systems or their components. Objective - objective of this research is to improve and optimize a fracture theory such that a unified concept on failure mechanisms for viscoelastic materials results. How work contributes - an extension of the knowledge about flaw healing in microscopic and macroscopic crack models for viscoelastic composite materials under compound loading will certainly improve solid propulsion systems.

Experimental investigation of the strain distribution around growing cracks in solid propellant will be studied for the case of compound loading. Specimens in the form of long strips with precut central cracks will be bonded to metal plates on their long edges and pulled normal to these edges. Speckled interferometry measurements will be used in this study, with the assistance of Mr. G. Maddux, AFFDL. In addition, based upon previously developed viscoelastic fracture theory, the influence of large thermal and/or moisture gradients will be examined in relation to damage occurrence in polymer materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0023, EXPERIMENTAL STRAIN ANALYSIS

C.A. WALKER, Univ. of Strathclyde, *Glasgow, Scotland, United Kingdom* (DF138670; AF-AFOSR-3007-76)

Knowledge and understanding concerning the fatigue behavior of composite materials are necessary if these materials are to be used safely and efficiently in aerospace structures. The purpose of this effort is to perform experimental strain analysis on composite materials and to investigate the fatigue behavior of notched composite specimens. Payoff is the transitioning of composite technology into the area of aircraft structures. Advantages include light weight, low cost and more versatile structures.

The Optecord surface strain analysis technique will be employed to investigate the strain field around nucleating and growing cracks in composite specimens and structures. Analysis will be performed to gain a better understanding of the fatigue behavior.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, AUTOMATIC TARGET HANDOFF USING CORRELATION TECHNIQUES

J.S. BOLAND, Auburn University, Engineering Extension Service, *Auburn, Alabama* 36830 (DA0F1182; DAAHO1-76-C-0396)

The objective is to determine the feasibility and hardware/software requirements for automatically handing off a target from a target acquisition device to an imaging missile seeker. Such an automatic handoff technique may be required to fully exploit imaging missile seekers used in a helicopter environment.

A survey is being conducted to evaluate various proposed concepts for automatic target correlation. A computer simulation of an original correlation concept is also being developed. In conjunction with the computer simulation, a closed loop TV system will be used to evaluate hardware impacts of the various correlation concepts. Hardware requirements and operational effectiveness will be defined for each correlation technique.

SUPPORTED BY U.S. Dept. of Defense, Missile Command, Guidance & Control Directorate

4.0002, TRANSONIC 3-D FLOW ANALYSIS

P.R. DODGE, Signal Companies Incorporated, *Phoenix, Arizona* 85034 (DF460080; F33615-76-C-2071)

The objectives of this program are: (1) to develop a three-dimensional, transonic, viscous computer code capable of calculating flow through a turbomachine blade row with reasonable rapidity on a CDC 6600 class computer, and (2) to develop criteria for optimization of the design of splitter vanes when used in axial compressor blade rows. The application of the results is in improved accuracy of compressor blade-row designs resulting in higher efficiency and reduced development costs for aircraft turbine engines.

This contractor has adopted a relaxation technique for his numerical analysis which has the potential of solving three-dimensional, transonic, viscous flow problems on smaller computers and using less time than the currently operational time-dependent methods. The latter methods currently require several hours on a CDC 7600 class computer to solve the type of problem envisioned. The contractor will test his analysis against extensive experimental data which the Air Force has for a specific cascade configuration containing splitter vanes and will also be able to compare it with the results of contract F33615-76-C-2011 in which another contractor is analyzing the same configuration using a three-dimensional time-dependent code. Assuming that results of adequate engineering accuracy are obtained, the new 3-d code will be used to develop optimization criteria for the design of splitter vanes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0003, TIME-DEPENDENT BOUNDARY LAYERS IN TRANSITION PREDICTION

J.H. STUHMILLER, Jaycor, *Del Mar, California* 92014 (DF047020; F49620-77-C-0030)

AF function - aerospace vehicles (ABRES). Deficiency - lack of adequate prediction methods for the transition of laminar to turbulent flows over ballistic reentry vehicles. Objective - to develop a method of transition prediction that will encompass all known nonempirical boundary layer theory leading to transition but which will be free of all present restrictive assumptions. How work contributes - this study will investigate the possibility of a novel method of approaching transition prediction theoretically and, if successful, should allow designers to optimally design reentry vehicles for heat and dynamic loadings.

An analytical-computational framework will be developed to apply boundary layer approximations to the solutions of the full Navier-Stokes equations for transition prediction.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0004, MECHANISMS OF EXHAUST POLLUTANT AND PLUME FORMATION IN CONTINUOUS COMBUSTION

G.S. SAMUELSEN, Univ. of California, School of Engineering, *Irvine, California* 92664 (DF039370; AF-AFOSR-2710-74)

AF function - weapon delivery and defense, advanced air-breathing engines. Deficiency - insufficient understanding of fundamental understanding of relative influence of physical and chemical processes involved in high-speed turbulent reacting flows and lack of realistic guidelines for predicting exhaust gas pollutants and plume formation. Objective - to clarify the relative influence and to formulate realistic analytical representation of the mechanisms and processes responsible for pollutant production and plume formation in jet engine continuous combustors. How work contributes - will provide additional understanding and realistic modeling of turbulent reactive flow fields not now available and contribute to establishing guidelines and techniques for reducing adverse environmental effects and controlling plume signatures in jet engine combustors by control and modification of combustion dynamic processes.

Studies of mechanisms responsible for pollutant and plume formation in jet engine continuous combustors will be carried out. Experiments will be conducted with both nonreacting and reacting flows in an opposed-reacting jet (ORJ) continuous flow facility under conditions closely simulating basic flow characteristics of gas turbine engines. Theoretically predicted profiles of flow properties will be compared with experimentally determined profiles to evaluate numerical techniques used to solve governing differential equations describing the ORJ and associated models of turbulence for nonreacting flows and coupled models of turbulence and chemical kinetics for reacting flows. Deficiencies in present models will be identified and used to formulate a refined theoretical model accurately predicting formation of combustion generated pollutants. Parametric studies will be performed to identify relative contribution of transport mechanisms, chemical kinetics and system parameters to pollutant formation. Particulate formation and luminosity related to alternate fuels will be studied. The potential of utilizing the ORJ in real gas turbine combustor applications (e.g., fuel injection, flame stabilization) to reduce pollutant formation by promoting lean combustion will also be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0005, EFFECT OF SOLUTE-VACANCY PAIRS ON THE PHYSICAL PROPERTIES OF SI-DOPED GAAS, AND OTHER COMPOUND SEMICONDUCTOR SYSTEMS

W.G. SPITZER, Univ. of Southern California, School of Engineering, *Los Angeles, California* 90007 (DF043410; AF-AFOSR-2990-76)

AF function - microwave electronic devices are essential elements of Air Force communications, reconnaissance, surveillance and countermeasure systems. Opportunity - improved performance of these systems can be expected from use of better materials in devices that process microwave signals. Present microwave solid-state device performance is limited by the defect structure in device materials. Objective - the objective of this research program is to obtain a more complete understanding of the defect structure of Si-doped GaAs and to track the effects of simple defect species on properties of GaAs that are important for signal processing devices. How work contributes -changes in quantities such as carrier density, infrared absorption, vacancy loop size and density, yield stress and luminescence caused by changes in thermodynamic conditions will be correlated and all explained on the basis of a common defect model.

The effect of varying concentrations of Si and thermal treatments on the free carrier concentration, infrared absorption, photoluminescence, critical resolved shear stress and defect structure of Si-doped GaAs will be systematically investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0006, STUDY OF TRANSONIC FLOW FIELDS ABOUT AIRCRAFT WITH APPLICATION TO EXTERNAL STORES
S.S. STAHARA, Nielsen Engin. & Research Inc., *Mountain View, California* 94040 (DF040660; F44620-75-C-0047)

AF function - advanced aerospace vehicles. Opportunity - improved trajectory prediction methods in the transonic regime. Objective -develop a computational program which will permit calculation of flow fields around wing body combinations in the transonic flow regime. How contributes - development of an analytical method for computing flow fields will reduce the present requirement for extensive and expensive wind tunnel testing.

The program will be divided into three phases. In the first phase a theoretical approach to compute flow fields will be developed. In the second phase a series of wind tunnel tests will be performed to gather the necessary baseline information. The third phase will consist of checking computational method against experimental data and making refinements to the computational method as required.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0007, FUNDAMENTAL RESEARCH STUDY OF PLASTIC FLOW AND FRACTURE IN BERYLLIUM 13387-MS
D. WEBSTER, Lockheed Missiles & Space Co., *Palo Alto, California* 94304 (DA0E9130; DAAG29 76 C 0051)

To study plastic flow and fracture of fine-grained beryllium. studies will be made of possible dislocation movements, pyramidal slip, room temperature grain boundary sliding, and the roles of microstructure, temperature and intermetallic compounds in fracture. Relevance - the proposed research is relevant to a host of Army applications in missile structures and in areas in general in which high strength and stiffness with light weight are required.

Beryllium cast from electrolytic flake and thermomechanically treated by upset forging to produce a nontextured product, and by extrusion to develop a highly textured product. Dislocation structures and morphology, boundary structures, evidence for grain boundary sliding, and other micromechanisms will be analyzed.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0008, DIGITAL FILTER DESIGN AND IMPLEMENTATION METHODS
T. BRUBAKER, Colorado State University, School of Engineering, *Fort Collins, Colorado* 80523 (DF095390; F33615-73-C-1253)

The objectives of this program are to determine filter design and implementation techniques which are applicable to digital avionics systems, to establish the effects of word lengths and sampling rates on filter errors, to demonstrate filter implementation techniques using programmable memories with multiplexed filter controllers, and to establish filter hierarchy schemes which increase system reliability.

Using a representative set of avionic signal processing tasks, this program will examine both time domain and frequency domain synthesis approaches which have application over a broad class of filter requirements. Using programmable memories and general-purpose digital computer, and an analog computer, several candidate designs will be simulated and evaluated against program objection. A real time demonstration will be conducted of suitable designs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0009, OPTICAL PHENOMENA IN INFRARED MATERIALS
J.W. QUINN, Optical Society of Amer. Inc., *Washington, District of Columbia* 20035 (DF044350; AF-AFOSR-3061-76)

AF function - solid-state optical devices are essential components of Air Force surveillance, communications, high-energy laser, guidance, and solar energy conversion systems. Opportunity - new and improved materials are needed that are capable of serving as windows in laser systems while other optical materials are needed for integrated optics, nonlinear optics, and IR systems. Objective - the objective of this conference is to obtain a comprehensive and intensive review of current progress in the research on optical phenomena in infrared materials. How work contributes - it is expected that this conference will contribute to the Air Force research program by providing a clear picture of the current situation and thus helping to set informed research priorities in the area of optical materials research.

The objective of this conference will be reached by bringing together the top researchers in government, industry, and university circles so that they may present formal papers on, and pursue discussions of, topics relevant to the optical materials area.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0010, FAILURE OF METAL MECHANICAL JOINTS UNDER BLAST LOADS
C.A. ROSS, State University of Fla. Sys., School of Engineering, *Gainesville, Florida* 32611 (DF045850; AF-AFOSR-3157-76)

AF function - to add needed knowledge in the area of aerospace vehicles, propulsion systems and weaponry. Understanding of the failure of structural elements because of damage by dynamic blast loads in phenomenologically complex and improved modeling methods is badly needed. Deficiency - in aerospace applications, the boundaries of many structural elements are bolted or riveted joints. As such, these joints are not to be traditionally modeled as fixed, simply supported or free conditions. In addition, computer modeling of these complexities has proven to be cost prohibitive. Therefore, a deficiency exists and work must be done to overcome same. Objective - this research will use energy methods as a prerequisite study procedure for analytical modeling of joint degradation from blast loads. Through the use of energy methods and analytical modeling, a better understanding of mechanical joints should evolve. How work contributes - additional scientific information about joints will serve to improve aerospace vehicles, propulsion systems and weaponry devices. In this way, better Air Force systems will be the long-range result.

Initially, Dr.Ross proposed to attack the problem by doing slow-to-intermediate strain rate studies using conventional mechanical property test methods. An in-depth literature search was also included in the initial task. In this expanded effort, Dr. Ross proposes to include analyses on plate stiffness with added stringer or rib stiffeners for a controlled response of panels between essentially fixed boundaries (bulkheads or forming rings).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0011, FINITE-ELEMENT ANALYSIS OF ELASTIC-PLASTIC THREE-DIMENSIONAL CRACKS
S.N. ATLURI, Georgia Inst. of Technology, School of Engineering, *Atlanta, Georgia* 30332 (DF038620; AF-AFOSR-2667-74)

AF function - airframe and engine structures of advanced aerospace vehicles require efficient and accurate analysis methods to assess failure processes. Deficiency - insufficient understanding and analysis methods exist in order for the Air Force to reliably design and maintain flight vehicles at cost and safety factors which are acceptable. Objective - the objective of this research is to develop new hybrid finite-element analysis techniques, considering nonlinear material behavior and three-dimensional response, for studying the bahavior of cracks and crack growth. How work contributes - this research will provide Air Force development programs and Air Force contractors with advanced techniques to improve structural reliability and damage tolerance.

This research uses as a basic technique the displacement hybrid finiteeelement approach. The approach has been used to study two-dimensional elastic fracture mechanics. This basic work is now being extended along two lines, the first being to include plasticity in the study of plane problems. This research will be extended to examine the j-integral, nonlinear energy release rate, crack tip blunting and stable crack growth. The second area is to incorporate the nonlinear materials behavior in three-dimensional analysis studies which are extensions of the two-dimensional investigations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0012, OPTIMAL CONTROL OF SYSTEMS WITH UNCERTAINTY

W.E. SCHMITENDORF, Northwestern University, Graduate School, *Chicago, Illinois* 60611 (DF042210; AF-AFOSR-2923-76)

AF function - the design of minmax control for Air Force system where there is uncertainty in the model. Deficiency - uncertainties arising from inevitable errors in the mathematical description of system accuracy. Objective - the objective of this proposal is to minimize the effects of uncertainty, using as a basis the assumption that nature is selecting the uncertainties as an adversary attempting to maximize the performance index which the controller is trying to minimize. How work contributes - research results in this area will promote greater confidence in control system operation for uncertain systems.

Emphasis in this research effort will be directed in five areas. Sufficient conditions for the free final time problem will be developed. Conditions will be developed for determining when there is a control which leads to a solution of the minmax problem such that for every admissible disturbance the system reaches the target. A nonvariational method or an indirect approach will be used to generate necessary conditions for a minmax solution to problems with general differential equations or cost. Minmax theory will be applied to the problem where an exact initial state measurement is not available and when the differential equation model contains uncertainty. Finally, methods will be developed for controlling a system based upon inaccurate measurement of the current state.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0013, STUDIES OF SOME BASIC PROBLEMS RELATED TO SATELLITE ANTENNA SYSTEMS

S.W. LEE, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (DF049270; AF-AFOSR-3375-77)

AF function - a major component of a communications satellite is its antenna. It has to meet stringent specifications in its beam position, gain, sidelobes, polarization and bandwidth. Deficiency - the two most commonly used satellite antennas are the reflector antenna and the wave-guide lens antenna. An incomplete procedure for their design prevents an accurate theoretical prediction of the antenna performance necessary for an optimal design. Objective - to eliminate some of the missing links in the design theory of satellite antennas. How work contributes - provide new methods applicable to design by solving related yet unsolved theoretical problems in electromagnetic theory.

1. Investigate the mutual coupling effects in a lens antenna, utilizing generalizations of infinite planar array diffraction and reflection analyses. 2. Explore novel and numerically efficient methods for calculating the secondary patterns of reflector and subreflector antennas.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0014, A FUNDAMENTAL STUDY OF A NEW FABRICATION TECHNIQUE FOR FIBER-REINFORCED ALUMINUM MATRIX COMPOSITES 13847-MS

R. MEHRABIAN, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (DA0E9048; DAAG29 76 G0170)

To study the fundamental parameters of a new processing technique, consisting of incorporating discontinuous fibers into a partially solidified alloy before casting, for fabrication of metal matrix composites. The research is relevant to the fabrication of fiber reinforced, metal matrix composites for Army applications, such as lightweight portable bridges, transmission housings for helicopters, and structural bulkheads for ground vehicles (armored personnel carrier). There is a potential application for the hubs for the super flywheel project at MERDC.

The program will include: (1) determination of the effect of processing parameters on microstructure, interphase interface characteristics, wetting of the fiber by the matrix, and mechanical properties of the composite, (2) determination of the effect of composite composition (fiber type, matrix alloy, volume fraction of fibers) and internal structure (fiber length, distribution, alignment, and orientation) on the mechanical properties of the composite, and (3) development of models to describe the reactions at the fiber-matrix interface.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0015, STUDIES OF EQUATORIAL GHZ SCINTILLATION PROBLEMS 14260-ELX

K.C. YEH, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (DA0E9192; DAAG29 76 G0286)

To study experimentally and theoretically equatorial scintillation of transionospheric radio signals. Relevance - this study will address the problem of signal fading in the DoD-wide navigation (global positioning system) and communication systems. For optimum signal design and failure analysis, signal fadings have to be known at location of maximum occurrence (equator).

Emphasis will be placed on gHz scintillations and their relations to scintillations at lower frequencies. Experiments with ATS-O6 and other geostationary satellites are proposed to study multifrequency dependence, multiple scattering effects and climatology of scintillations. Experimental data will be compared with model computations.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0016, MONOLITHIC ZINC OXIDE SAW STRUCTURES

R.L. GUNSHOR, Purdue University, Purdue Research Foundation, *Lafayette, Indiana* 47907 (DF048470; AF-AFOSR-3304-77)

AF function - microwave signal processing devices are essential components of Air Force communications, reconnaissance, and electronic countermeasures systems. Opportunity - surface acoustic wave (SAW) devices present the opportunity to perform many nonlinear signal processing functions such as frequency mixing, harmonic generation, signal convolution and correlation, signal storage, and optical imaging and image processing. Such nonlinear functions can most efficiently be performed through the interaction of SAWs with an adjacent semiconductor material. One configuration which allows such an interaction is the monolithic structure of a SAW-supporting piezoelectric and a semiconductor material. The monolithic structure offers the advantages of ruggedness, reproducibility, and compatibility with modern integrated circuit fabrication techniques. Objective - the objective of this work is to improve the operational behavior of the monolithic zinc oxide/silicon dioxide/silicon configuration, a configuration which is being investigated by a number of researchers for its potential as an implementation as a nonlinear SAW signal processing system. How work contributes - this work will be aimed specifically at blocking and/or controlling charge injection into the zinc oxide, addressing the problems of frequency dispersion, and minimizing sputtering damage when the zinc oxide is deposited.

The zinc oxide/silicon dioxide/silicon structure employs aluminum contacts on the zinc oxide. This combination results in an ohmic contact which allows the injection of electrons into the zinc oxide under reverse bias conditions. In most applications this situation is undesirable and should be eliminated. In this work the charge injection will be blocked by placing an insulating layer of

aluminum oxide or aluminum nitride between the metallization and the zinc oxide. Not only will these insulating layers block the charge injection but they should also be crucial to the control and elimination of dispersion in the monolithic configuration. Problems are also encountered when the sputtering of zinc oxide into the oxidized silicon substrate causes a degradation of the silicon dioxide layer and the silicon-silicon dioxide interface properties. This work proposes to solve this problem by placing a protective layer of material on the silicon dioxide prior to sputtering. (Text abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0017, DISTURBANCE ACCOMMODATION CONTROL RESEARCH

N.K. LOH, Univ. of Iowa, School of Engineering, *Iowa City, Iowa* 52240 (DA0Q1628; DAAA09 76 C 2048)

Establish simple effective control laws using feedback control and disturbance accommodation techniques for application to helicopter turret and tank control systems with broad class of disturbances.

The main performance objective of a feedback control system is to maintain a set-point regulation or to cause the system output to follow an input command. This means that the control system must perform satisfactorily every time and not in the average. The statistical properties of system disturbances are used in stochastic optimal control, thus giving average properties of the system process. This results in a satisfactory average performance although the system may fail to give acceptable individual performance. Control system using a priori waveform modes of the expected broad class of disturbances will be able to maintain tight regulation and close tracking at all times. This method, called disturbance accommodation (DA), makes the feedback controller provide (1) a cancelling control signal or disturbance adaptive and (2) feedback for regulation. This DA method will be investigated and generalized for weapon system implementation.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Fire Control & Small Caliber Weapon Systems Lab.

4.0018, DUAL-BAND ARRAY TECHNIQUE

R. LEWIS, Raytheon Company, *Bedford, Massachusetts* 01730 (DF900720; F19628-77-C-0112)

AF function - aircraft-to-satellite communication and other aircraft flush-mounted applications. Deficiency - improved antenna performance is required particularly to achieve independent beams at widely spaced frequencies. Research - investigation of new antenna techniques for dual-band array elements. How research contributes - most present array techniques allow only one beam to be scanned at one given frequency. The several exceptions that do allow dual independent beams have relatively low aperature efficiency. New dual-band array techniques would allow lightweight arrays with efficient use of the aircraft mounting space.

The approach is to investigate the properties of a particular kind of dual-band phased array technique that used dielectric slab-loaded waveguide elements to provide separate control of two widely spaced frequencies.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0019, RESPONSE OF THERMAL/MECHANICAL LOADED STRUCTURES

N.P. HOBBS, Kaman Science Corporation, *Burlington, Massachusetts* (DN575186; N00014-75-C-0121)

Research will be conducted and analytical techniques developed for the prediction of structural response and damage to Navy vehicles subjected to high-intensity thermal and time-dependent mechanical loading environments. Factors to be considered included thermal radiative, convective, conductive and melting effects as well as temperature-dependent degradation of thermal and structural properties such as yield stress, modulus of elasticity, ultimate strength, specific heat, etc. Composite and honeycomb material construction is to be included.

A laser response computer code has been developed, from the existing trap code, which calculates the temperature and stress response of aircraft missile structures subjected to the thermal irradiation from a laser. The principal extensions made are introduction of a moving laser beam as a thermal source and replacement of two-dimensional treatment. In this study user documentation will be improved and the code will be used to study thermal/mechanical load effects on the F-15 aircraft.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0020, ADSORPTION OF MOLECULES ON GRAPHITE SURFACES

M.S. DRESSELHAUS, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (DF049500; AF-AFOSR-3391-77)

AF function - airborne systems utilized for command, control, communications, reconnaissance and surveillance depend heavily upon interconnected electronic components. Opportunity - improved performance of these systems can be expected from the use of less expensive, lighter materials such as intercalated graphite compounds for electrical conductors. Intercalated graphite compounds, weighing about one fourth of that of copper, could have conductivities greater than that of copper. Objective - the objective is to contribute to the understanding of the basic physical properties of intercalated graphite compounds. How work contributes - this work should contribute to the development of intercalated graphite compounds that could replace copper as the dominant electrical conductor for airborne systems.

Raman and infrared spectroscopy will be used to examine in detail the vibrational modes associated with both the molecules absorbed on surfaces and the absorbing substrates. The frequency shifts together with the observed Raman and infrared selection rules will be interpreted to yield information on the orientation of the absorbed molecules and on their ordering at the surface.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0021, WAKE STUDIES RELATED TO WAVERIDER AERODYNAMIC SHAPES

M. FINSTON, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (DF042900; F44620-76-C-0049)

AF function - advanced aerospace vehicles. Opportunity - obtain preliminary aerodynamic information about a possible new class of reentry bodies. Objective - map the near wake and obtain aerodynamic forces and moments on a four-pointed reentrant pyramid-shaped body. How contributes - will provide basic aerodynamic data which will enable reentry vehicle designers to predict possible uses of this new shape.

The proposed research program will be experimental in nature. Using the magnetic balance system a pyramid body will be suspended in a high-speed flow and the near wake mapped using hot film and impact pressure probes. Measurements will also be made of lift, drag and pitching moment on a four-pointed reentrant pyramid-shaped body.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0022, FUNDAMENTAL MECHANISMS OF NONEQUILIBRIUM MHD LASING PHENOMENA

J.L. KERREBROCK, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (DF043270; F44620-76-C-0067)

AF function - weapon defense and offense, advanced high-power lasers. Deficiency - lack of fundamental understanding of physical phenomena associated with MHD lasers and lack of experimental evidence defining capabilities of MHD generator to cause population inversion directly in a single cavity and laser power production from thermal energy sources without intermediate conversion to electric power. Objectives - to understand and develop accurate theoretical and mathematical models accurately describing the phenomena associated with nonequilibrium

MHD laser processes. How work contributes - will provide additional understanding and realistic analytical modeling of the nonequilibrium MHD lasing phenomena and will contribute to the technology base required for realistic evaluation and development of such advanced laser devices.

Experimental and theoretical studies of the MHD laser process will be carried out. The MHD laser will be modeled by pulsed supersonic flow through a magnetic field of cesiated helium from a heated plenum chamber, the flow being along the axis of the optical cavity. All important parameters of the plasma will be properly simulated, including the flow Mach number, electron to gas temperature ratio, gas composition and Hall parameter. Diagnostics will include measurements of electric field and radiation from both electronically and vibrationally excited species so as to define the kinetic processes occurring during the pulse. The optical gain at 10.6 microns will be measured and the results correlated with the kinetic measurements. A numerical model of the MHD laser will be used to assess the overall performance. The model will include gas dynamic as well as gas kinetic phenomena.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0023, MHD POWER GENERATOR (VIKING SERIES) WITH HYDROCARBON FUELS

R. KESSLER, Avco Corporation, *Everett, Massachusetts* 02149 (DF452140; F33615-75-C-2047)

The purpose of this program is to establish certain aspects of MHD generator performance important to the design of compact, high-performance MHD generators. The program should result in increased output on the Viking I generator and design criteria to develop a high-power MHD electrical generator.

The research will consist of testing with the objective of increasing the output and specific power output.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0024, HYPERSONIC HEAT TRANSFER MEASUREMENTS

V. DICRISTINA, Avco Corporation, *Wilmington, Massachusetts* 01887 (DF042620; F49620-77-C-0035)

AF function - aerospace vehicles. Deficiency - unpredicted or poorly predicted transition from laminar to turbulent flow on the nose tips of ABRES shapes has caused numerous severe problems of heating and aerodynamic instability. Ground-based flow facilities do not simulate all of the flow parameters of free flight that influence these phenomena. One facility, which is rather economical to operate, located at the VKI, Brussels, is capable of simultaneous simulation of Mach number and Reynolds number of these flights, while not achieving the sustained, realistic running time. Nevertheless, heat transfer and pressure distribution measurements on a number of nose tip shapes of interest to ABRES appear to be desirable. Objective - to extend and confirm data previously obtained by VKI with Avco support and coordination. How work contributes - the results will help with design of nose tips which ameliorate the problems alluded to under Deficiency.

Avco will supply the model(s) and instrumentation and will coordinate the test schedule with AFOSR and Samso to assure that the most appropriate possible measurements are made. VKI will run the experiments in the longshot facility. Resulting data will be given to Avco for analysis, as well as undergoing analysis at VKI.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0025, MICROWAVE SEMICONDUCTOR MATERIALS AND DEVICES

G.I. HADDAD, Univ. of Michigan, School of Engineering, *Ann Arbor, Michigan* 48106 (DF042330; AF-AFOSR-2939-76)

AF function - microwave circuits are essential elements of Air Force reconnaissance and surveillance, communications, and countermeasures systems. Opportunity - the development of improved solid-state microwave circuits requires complete understanding and full development of these microwave devices which can generate, amplify, and process microwave signals. Present solid-state microwave devices have not reached their full potential. Objective - the objective of this work is to determine the optimum design of Baritt, Impatt and tunnel transit time devices. How work contributes - this research contributes to the knowledge required to develop lower noise, higher power, more efficient and longer mean-time-failure solid-state microwave devices.

This research investigates effects of materials parameters, and doping profiles on performance of Baritt and Impatt devices.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0026, 4-D INTEGRATED SYSTEM DEMONSTRATION

M.W. BIRD, Lear Siegler Incorporated, *Grand Rapids, Michigan* 49508 (DF139740; F33615-77-C-3025)

The 4-D Integrated System demonstration program will serve to prove the feasibility of the total mission integration concept. Future tactical commanders will be required to exercise control over numerous aircraft with significantly different performance characteristics and mission objectives. With this effort the advanced integration concepts of the 4-Dimensional Integrated System (4-DIS) will be incorporated into a fixed base simulator and demonstrated through a pilot-in-the-loop evaluation to prove feasibility of the concept. The 4-DIS concept will be compatible with the Joint Tactical Information Distribution System and the Global Position System and will specifically address the command, communications and control requirements of the USAF.

Perform an experimental simulation program to evaluate and demonstrate the 4-Dimensional Integrated System as a potential solution to the future close air support mission. The areas to be addressed are functional definition, algorithm development, simulator development and operational concept demonstration. Programs such as the Joint Tactical Information System, Global Position System, Digital Avionics Information System and Digital Flight Control System will be closely monitored to insure compatibility with these ongoing USAF programs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0027, STUDY OF THE EMP INTERACTION WITH AIRCRAFT OVER AN IMPERFECT GROUND PLANE

C.D. TAYLOR, Mississippi St. University, School of Engineering, *Mississippi State, Mississippi* 39762 (DF048890; AF-AFOSR-3342-77)

AF function - an electromagnetic pulse such as the nuclear EMP incident on an aircraft will induce current and charge densities on its surface. The interior fields are related to the exterior fields and a knowledge of the external fields is the first step in determining the currents and voltages induced in the electrical systems of the aircraft. Simulation facilities to test the response of aircraft to the nuclear EMP generally require that the aircraft rest on a concrete pad which eliminates the possibility of testing the inflight response. Theoretical models are required to extrapolate the test data from ground-based measurements to predict the in-flight response. Deficiency - models are available to predict the induced current density on metallic objects and, generally, the flight mode can be handled. Agreement for the ground alert mode is not as good and proximity to an imperfectly conducting ground plane has not been treated at all. Objective - the singularity expansion method (SEM) will be applied to determine the current and charge induced on models of aircraft (intersecting cylinders and intersecting bodies of revolution) near a ground plane. Contribution -this work will provide usable analytical models for predicting the EMP response of aircraft-like objects located in proximity to an imperfect ground plane. This is an important step in the goal of extrapolating test data to the free-flight mode.

Four tasks will be undertaken - (1) a parametric singularity expansion method (SEM) study of two perpendicular intersecting cylinders parallel to a perfect ground plane. The parameters will include aircraft-like dimensions and heights above the ground plane. Natural modes, natural frequencies, coupling vectors and coupling coefficients are to be obtained. Time domain results will also be obtained, (2) SEM results for two perpendicular intersect-

ing bodies of revolution parallel to a perfect ground plane are to be obtained and compared with the previous results, (3) SEM results for two perpendicular intersecting cylinders parallel to an imperfect ground are to be obtained using the exact Sommerfeld formulation. Aircraft-like dimensions and heights above the ground plane with typical electrical parameters are to be considered. A comparison with the results for a perfect ground plane will be made. (Text abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0028, APERTURE EXCITATION OF SINGLE-CONDUCTOR AND MULTICONDUCTOR LINES
D.R. WILTON, Univ. of Mississippi, School of Engineering, *University, Mississippi* 38677 (DF043960; AF-AFOSR-3025-76)

AF function - the Air Force aircraft EMP assessment and hardening program under the direction of the AFWL depends on systems testing and a comprehensive analytical program to evaluate tests and provide a prediction capability for future systems. The problem to be investigated in this program is the penetration of electromagnetic energy through a small aperture in a metal shield and the coupling of this energy to wires located behind the shield. Such a configuration occurs in aircraft. Opportunity - this problem has been investigated in the past in its simplest form, where induced voltages and currents on a single-conductor wire were determined. This work will concentrate on improved coupling treatments and extensions to multiconductor lines. Objective -the main objective of this work is a useful calculational model for wires excited through an aperture for use in EMP assessment methodology. Contributions - the idealized physical configuration of the problem will be an infinite ground plane with a small circular aperture. It is necessary to compute the amount of energy coupled from a plane wave incident below the ground plane to wires located above the plane. A complete treatment of this problem and improvements to previous work is an important problem for EMP assessment.

The investigation will concentrate on the following improvements and extensions of the equivalent circuit for the coupling mechanism: (a) evaluate the coupling coefficients and the transmission line constants of the quasi-TEM multiconductor transmission lines with and without the presence of dielectrics, (b) improve the accuracy of the equivalent circuit by adding the reactive elements which represent energy stored in the immediate vicinity of the aperture, (c) investigate the interaction between the aperture and the wire in order to further improve the accuracy of the equivalent circuit.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0029, UNSTEADY LIFTING SURFACE THEORY
J.E. YATES, Aeronautical Res. Associates, *Princeton, New Jersey* 08540 (DN675261; N00014-76-C-0576)

The development of accurate methods for the calculation of unsteady loads on wings is essential for the prediction of their response to gusts, and for the prediction of their aeroelastic behavior. The objective of this research is to extend inviscid unsteady aerodynamic theory to account for 'finite boundary layer and wake effects' in the formulation of a three-dimensional wing theory.

Unsteady analyses for aerodynamic design have been based largely on inviscid linearized theories. For lightly loaded wings such approximations are reasonable and yield results quite useful for design. However, for more highly loaded lifting surfaces whose boundary layers and wakes are much thicker, the neglect of such effects can lead to serious design deficiencies. In the planned research these viscous effects will be modelled within the framework of an inviscid rotational flow. The inviscid shear layer will be used to represent the outer portion of a turbulent boundary layer (the sub-layer will be neglected) and this region will interact with the external unsteady flow. The analysis will be applicable to subsonic flows.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0030, CONVECTIVE IGNITION OF NITROCELLULOSE-BASED PROPELLANTS IN NONSTEADY FLOW FIELDS 14200-EX
M. SUMMERFIELD, Princeton University, School of Engin. & Appl. Sci., *Princeton, New Jersey* 08540 (DA0E9146; DAAG29 76 G0270)

To determine the site and mode of convective ignition of propellant cylinders in cross flow and to determine the influence of igniter gas composition on the ignition events. Relevance - this work relates to the ignition of propellants, and is needed for the rational design of charges for guns.

The research program will encompass flame theory, detailed chemistry, and fluid mechanics. Direct observation of the ignition event will be made with attention to the location and time scale of condensed phase and gas phase events. Gas phase conductivity and/or radiation emitted from the gas in front of and behind the cylinder will reveal how rapidly gas phase flame development follows surface gasification. Time of ignition will be detected by analysis of the pressure-time signal from pressure transducers in the test section and by IR detectors.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0031, MICROWAVE, ELECTROMAGNETIC THEORY AND INFORMATION PROCESSES (JSEP)
A.A. OLINER, Polytechnic Inst. of New York, School of Science & Engin., *Brooklyn, New York* 11201 (DF001680; F44620-74-C-0056)

AF function - electronic research is essential to all Air Force missions and functions, especially aerospace reconnaissance, communications, surveillance, navigation, command and control of operating forces, and gathering, processing, and transmission of intelligence and information. Technology for all of these functions requires more compact, lower power consumption, higher sensitivity and more reliable electronic components, networks and systems. Opportunity -this technology is dependent on continued research on properties of electronic materials, circuits, and systems. Objective - the Joint Services Electronics Program (JSEP) provides the research baseline in the electronic sciences for all three military services. How work contributes - jointly and equally supported and managed by the Air Force, Army and Navy, this program provides the DoD with a hard-code electronic research capability which includes a highly flexible, quick response to new research opportunities over a broad area of electronic science and engineering.

This JSEP effort addresses itself to research in electromagnetics and waveguide techniques, quantum electronics and optics, solid-state electronics and materials, communications and computers, and systems control and network theory.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0032, STUDIES OF LASER-INDUCED PHOTOCHEMICAL KINETICS
R.A. MCFARLANE, Cornell University, School of Engineering, *Ithaca, New York* 14850 (DF040260; AF-AFOSR-2781-75)

AF function - communications, detection, reconnaissance, weaponry. Deficiency - there is presently no chemically pumped, electronic transition laser operating near the visible region of the spectrum. Objective - study the production and deactivation rates of electronically excited iodine atoms. How work contributes - the results are important for modeling the kinetics of pulsed and CW laser systems based on the 1.315 micron transition of iodine and for the determination of specific reagents for optimum excited atom production.

Extend the present experimental capability for measuring the quenching of I star by various molecules at room temperature to cover temperatures from 0 degrees C to 400 degrees C. Initial measurements will be on the quenchants, I2, O2, H2O, D2O, N2, H2, D2 and HD. Continue investigation of the early rise-time dependence of I star production when photolyzing I1 below the dissociation limit. Effects of different collision partners will be explored to confirm the collisional release mechanism for a variety of added molecules. Determine the wavelength dependence of

the I star atom production which occurs upon the photolysis of a variety of alkyl iodides at excitation wavelengths between 2500 - 3200 Angstroms.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0033, EFFECT OF BODY FORCES ON MOTION AND HEAT TRANSFER OF CONFINED FLUIDS

S. OSTRACH, Case Western Reserve Univ., School of Engineering, *Cleveland, Ohio* 44106 (DF046540; AF-AFOSR-3171-77)

AF function - advanced aerospace vehicles. Opportunity - improve efficiency of electronic equipment cooling systems, waste heat disposal and fuel cooling systems. Objective - to increase the understanding of confined flows and heat transfer relevant to fuel and hydraulic systems, tankage, and aircraft equipment environmental control. How work contributes - this work is building a step-by-step understanding of flow features and configurations that are common, albeit poorly understood, features of vehicle equipment operation. Any increased understanding of these flows will yield hydraulic fuel and temperature control systems of better performance and decreased weight.

Experiments will be performed on heat transfer augmentation by thermal instability, on natural convection with multiple heat flow directions, on the interaction of a buoyant plume in a stratified environment, and on convection due to combined temperature and concentration gradients. Papers will be prepared describing completed work.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0034, TIME-DEPENDENT HYPERSONIC VISCOUS INTERACTIONS

E. RESHOTKO, Case Western Reserve Univ., School of Engineering, *Cleveland, Ohio* 44106 (DF037500; AF-AFOSR-2577-74)

AF function - aerospace vehicles. Deficiency - lack of knowledge of effects of free stream turbulence on boundary layer behavior. Objective - to develop analytical procedures for predicting boundary layer transition due to free stream turbulence. Evaluation of the influence of test facilities on boundary layer transition in the range of Mach 7 to Mach 10 will be accomplished. How work contributes - this research is part of a comprehensive program in turbulence and turbulent flow to provide a better understanding of the phenomena so that the effects can be considered in the design of advanced aerospace vehicles.

An analytical study modeling the effect of vortices and irrotational traveling wave disturbances in the free stream on boundary layer transition. Where convenient, the analytical study is supplemented with numerical experiments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0035, FLUID DYNAMIC INTERACTIONS IN MULTIPLE NOZZLE ARRAYS

S.L. PETRIE, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (DF037120; AF-AFOSR-2537-73)

AF function - weaponry and aerospace vehicles. Deficiency - in gas lasers, particularly chemical lasers, the mixing of supersonic streams of reactants in the wake regions behind nozzle elements dictates difficult design compromises between optical properties and rapid mixing and chemical reaction. Objective - to gain more basic understanding of the details of mixing between coplanar supersonic streams of dissimilar gases. How work contributes - better understanding of the mixing phenomena will facilitate a rational design procedure aimed at finding a suitable compromise between optical requirements and requirements needed for providing the necessary chemical and gas flow environments.

An arc-heated wind tunnel fitted with two coplanar supersonic nozzles with separately controlled supply plenums will be used for this mixing study. Temperature turbulence in the mixing region will be monitored on a time-resolved basis by means of electron beam spectroscopy. Sources of turbulence in the flow field will be identified and their importance defined. Methods for measuring the time-resolved vibrational temperature of the gas will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0036, COHERENT ANTI-STOKES RADIATION IN GASES

R.B. WON, Systems Research Labs. Inc., *Dayton, Ohio* 45432 (DF458860; F33615-75-C-1116)

AF function - laser development, combustion studies, compressor studies, chemical emissions, aerodynamic testing. Deficiency - on-site methods are needed to determine temporally and spatially resolved species concentrations in reacting and nonreacting flows. Research -development of an experimental base for the applications of coherent anti-Stokes Raman spectroscopy to the measurement of species concentrations in plasma and gases. How research contributes -experimental research at ONERA and AFAPL shows that coherent anti-Stokes Raman scattering can be generated in molecular gases by using a tunable dye laser to generate the required intense Stokes beam. The intensity of the anti-Stokes signal, at one atmosphere pressure, is many orders of magnitude greater than that produced by spontaneous Raman scattering. This new development will be investigated and the corresponding hardware developed to allow tests to be made on combustion and laser systems.

The original measurements at ONERA were restricted to H sub 2 because the high-intensity Stokes radiation was generated in high-pressure hydrogen cells. To extend the method to other species, high-power, tunable lasers will be used to generate the Stokes beam at the required frequency for given molecular species. Several systems will be designed based on available pump and tunable lasers. An assessment will be made of the applicability of these systems to current Air Force research and development programs. Coordination of this program has been made with other AFSC laboratories and government agencies.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0037, PLASMA PROPERTIES OF GAS LASERS

P. BLETZINGER, U.S. Air Force, Aeropropulsion Laboratory, *Dayton, Ohio* 45433 (DF458840)

AF function - electrical discharges applied to gas laser and high-power technology. Deficiency - present electrical discharge lasers are limited in performance and lifetime by discharge instabilities, contamination and electrode or boundary effects. Research - the in-house experimental program uses sample discharges such as DC, RF or microwave, UV or electron-beam preionized plasmas as representative of those used in lasers or high-power switches of current AF interest. The application of a wide variety of excitation methods and diagnostics will permit a detailed and accurate determination of the characteristics, limitations of and possible improvements to these discharges. How research contributes - this research supports several Air Force requirements in the area of medium- and high-power lasers in the infrared and visible wavelength range as well as switch technology. Research also supports data requirements of theoretical studies under WU 12.

The research program uses small in-house experiments to generate and analyze accurately defined CW or pulsed discharges. Excitation methods include standard very high stability DC discharges, pulsed and DC RF and microwave discharges as well as pulsed and DC UV or electron-beam preionized discharges. The diagnostics are compatible with the well-defined discharges and include time-resolved spectroscopy from the vacuum UV to medium infrared and electrical diagnostics. Presently, emphasis is on the analysis of population distributions in molecular gases under various excitation conditions, analysis of preionization mechanisms and seed characterization of UV-preionized discharges and instability mechanisms in conventional and e-beam discharges. Future plans call for research on electronegative discharges relevant to lasers and switches.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0038, TRANSIENT AIRFLOW MEASUREMENT
S. WEBOFER, Arnold Research Org. Inc., *Tullahoma, Tennessee* 37389 (DF420953; F40600-75-C-0001)

The objective of this effort is to develop a method to measure engine transient airflow and to calibrate an Air Force Aeropropulsion Laboratory (AFAPL) engine inlet bellmouth system for use in transient airflow testsing of a J85 engine.

An experimental test facility will be fabricated using a critical flow Venturi in series with a throttling plug assembly (TPA). The TPA will consist of a shrouded bulletnose and strut assmbly and a translating variable-area plug. The TPA will be calibrated for airflow rates as a function of plug position.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Arnold Engineering & Development Center

4.0039, TURBULENCE AND SHEAR LAYERS IN HIGH ENERGY LASERS
D.A. RUSSELL, Univ. of Washington, School of Engineering, *Seattle, Washington* 98105 (DF036570; AF-AFOSR-3450-77)

AF function - weaponry, aerospace vehicles. Deficiency - high-energy lasers encounter a number of difficult problems in high-speed gas flow. Among these are nozzle flows, mixing layers and wakes with and without chemical reaction, and shock wave patterns downstream of multiple nozzles. All of these flow features, as well as many others, affect laser performance in terms of power output, gas consumption, beam quality and coherence. More detailed understanding of these phenomena is needed in order to optimize designs of gas flow lasers. Objective - to investigate nozzle flows, mixing regions, shear layers, and wave patterns downstream of multiple supersonic nozzles, and to relate these phenomena to laser performance. How work contributes - detailed quantitative understanding of the fluid flow features in lasers will make possible the rational use of design trade-off methods to optimize practical high-power gas flow lasers.

A combined experimental and analytical program is being conducted. The current extension of the work will include study of reacting mixing layers, experimental study of the flow downstream of an array of mixing nozzles, further refinements and simplifications of the present wave calculation procedures, and fluid mechanical problems of multi-pulsed lasers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, ANALYSIS OF MAGNETIC AND AURORAL DATA FROM THE IMS ALASKA MERIDIAN CHAIN OBSERVATORIES
S. AKASOFU, Univ. of Alaska, Geophysical Institute, *Fairbanks, Alaska* 99701 (ATM76-12259)

In a companion grant entitled 'International Magnetospheric Study (IMS) Alaska Meridian and Longitudinal Array of Magnetometers and All-Sky Cameras', the Geophysical Institute of the University of Alaska will install, maintain and operate magnetometers, all-sky cameras and riometers in a chain of 17 observatories.

This grant will support the processing and analysis of a variety of data taken from the Alaskan meridian chain in order to facilitate studies with satellite and other ground-based data. The project will facilitate a cooperative program with the Environmental Data Service (EDS/NOAA), Space Environment Laboratory (SEL/NOAA) and the two Canadian meridian chains by providing processed auroral and magnetic data to the IMS scientific community. As such this grant will permit the goals of IMS to be achieved, i.e., coordinated research on magnetospheric dynamics.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0002, LIDAR TECHNIQUES FOR EVALUATION OF AEROSOL, CLOUD AND PRECIPITATION OPTICAL AND PHYSICAL DENSITIES 13833-GS
E.E. UTHE, S R I International, *Menlo Park, California* 94025 (DA0E9274; DAAG29 77 C 0001)

Develop and evaluate quantitative techniques for deriving from lidar backscatter signals, atmospheric optical and physical density parameters relating to aerosol, cloud and precipitation distribution. Relevance - the work addresses atmospheric transmission capabilities in the infrared frequency of military interest such as terminal homing and target acquisition devices and laser target designators. It is also important for development of remote ceiling and visibility sensors, chemical agent detectors, pollution monitoring at military arsenals and depots, and development of aerosols to be disseminated for screening purposes.

Reconfigure the wavelength and polarization of the mobile SRI lidar system to increase the capabilities of the lidar for quantitatively specifying atmospheric optical and physical density parameters relating to aerosols, cloud and precipitation distribution in the mesoscale. Develop and evaluate algorithms and processing signature data in terms of absolute atmospheric optical and physical density information accounting for atmospheric attenuation and scattering effects, and size and shape characteristics of the scattering particles. Evaluate experimentally, via two field programs, the accuracy and limitations of the techniques developed.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

5.0003, A STUDY OF PC 3,4 MICROPULSATIONS WITH INTERPLANETARY MAGNETIC FIELD ORIENTATION
E.W. GREENSTADT, Thompson Ramo Wooldridge Inc., *Redondo Beach, California* 90278 (DF046410; F49620-77-C-0018)

AF function - the ability to predict atmospheric disturbances caused by interplanetary phenomena is a standing Air Force requirement. The capability to make these predictions from ground-based observations is particularly attractive because of the ease and economy with which these observations could be made. Deficiency - at this time there is no set of observations, from the ground or from space, that gives an accurate prediction of ionospheric disturbances. Objective - the objective of this study is to pursue the possibility that certain ionospheric disturbances occur during particular configurations of the interplanetary magnetic field. Contribution - this study will contribute to a greater understanding of the solar-terrestrial relationship and could lead to an economical predictive capability for ionospheric disturbances.

The following steps will be taken in pursuing this study, 1. improvement of the treatment of existing data to reduce the scatter in the present correlations, 2. Examination of the hydromagnetic descriptions and wave properties of the magnetosheath to refine the investigator's model of PC 3-4 excitation by characterizing more precisely the patterns of shock noise expected at the magnetopause, 3. assembly of a schedule of simultaneous acquisitions of suitable micropulsation and interplanetary field measurements to serve as a potential data base for correlation studies.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

5.0004, COHERENT LIDAR DEVELOPMENT
P. MANDICS, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (RAA74325)

PROJECT OBJECTIVE: Develop infrared pulse coherent lidar system to measure atmospheric winds and species remotely.

CURRENT YEAR PLAN: Initiate development of pulse coherent lidar hardware.

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0005, ENVIRONMENT SUPPORT TECHNOLOGY - RESEARCH ON ATMOSPHERIC DYNAMICS & NUMERICAL WEATHER PREDICTIONS FOR NAVY OPERATIONS
H.J. MASTENBROOK, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN520028)

Improve the Navy capability for numerical weather prediction by determining the distribution of atmospheric constituents which affect atmospheric density and the radiative budget. Provide reference measurements for the assessment of climatic impact of Navy aircraft and missile systems which pollute the stratosphere.

Balloon-borne and aircraft instrument systems are used to measure vertical and horizontal distributions of atmospheric trace constituents over an extended time period for time and space variability and causal relationships.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

5.0006, AQAM DEVELOPMENT

D.M. ROTE, Argonne National Laboratory, *Argonne, Illinois* 60439 (DF407140)

To develop a technique which can predict the effect of Air Force operations on the community air quality. The technique, designated AQAM (air quality assessment model), will be a computerized mathematical model which accurately considers aircraft, ground mobile, and stationary sources commonly found on Air Force bases. This model is required for the proper development of costly air pollution control strategies and in situations where detailed environmental assessments are necessary.

A number of air pollution models have previously been developed. However, no single technique exists which can handle all Air Force sources and predict downwind concentrations under different meteorological conditions. The new model (AQAM) combines features from previous models as well as new ones. It will have four components: (1) source emission inventory, (2) short-term program, (3) long-term program, and (4) meteorological data program. The source emission inventory stores emission measurements from other collateral work units and combines them with operational data to compute the annual emissions from many sources for five types of pollutants. The short-term program predicts 1 hour downwind air quality concentrations typical of any single meteorological condition. The long-term program predicts annual average concentrations resulting from a composite of all meteorological conditions. This statistical composite is obtained from the meteorological data program prepared by the USAF Environmental Technical Applications Center.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Civil & Environmental Engineering Development Office

5.0007, UTILIZATION OF AIRCRAFT-ACQUIRED MULTISPECTRAL DATA TO MONITOR CHANGE ON SURFACE MINED LANDS

A.T. JOYCE, U.S. Natl. Aero. & Space Adm., Earth Resources Laboratory, *Slidell, Louisiana* 70548 (D5-E771; V625C-18)

OBJECTIVE: To develop a technique that would allow for the automated processing of aircraft-acquired multispectral scanner data without the necessary pre-mission ground truth activities. This would facititate the real time processing of the numerous data sets that will be necessary if surface mines in the western U.S. are to be monitored on a continual basis.

TECHNICAL APPROACH: Aircraft-acquired (1975) multispectral scanner data will be processed using NASA/ERL software package 'SEARCH'. This program permits the investigator to automatically scan an entire data set, locate areas of homogeneous land cover (by specifying the magnitude of several statistical parameters) and subsequently classify the entire data set based on the selected areas, without manual selection of training samples and the associated statistics development. At this time, the data will be subjected to a structured experiment, during which time the various input parameters will be systematically altered. The results will be analyzed and the results forwarded to EPA/EMSL. Data from 1977 will then be analyzed, using the refined technique developed from the above experiment. The results of this run will also be forwarded to EPA/EMSL.

PROGRESS: Initial 'SEARCH' runs complete, structured experiment underway; 1977 data in house. 06/78 Final Report.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Energy Minerals & Industry

5.0008, NAVY ENVIRONMENT - FLUORESCENT MATTER IN COASTAL AND OCEANIC REGIONS

G.D. HICKMAN, Applied Science Technol. Inc., *Germantown, Maryland* 20767 (DN675375; N00014-76-C-0711)

This study is to provide background information on fluorescent matter in coastal zones and the oceans in general. The remote sensing of physical characteristics of coastal waters such as currents, eddies, sediment transport, temperature, salinity, sound propagation, electromagnetic penetration, etc., cannot be fully evaluated without first considering techniques using the fluorescence of certain materials that can be used as indicators for the characteristics. All the quoted physical parameters are of interest to the Navy and Marine Corps.

A large number of specific studies on oceanic fluorescence has been undertaken and the theory thoroughly investigated, but no in-depth compilation on the actual occurrence of fluorescent matter seems to exist. The principal investigator will make literature search and conduct discussions to compile information on the horizontal, vertical, and temporal distribution of fluorescent matter in coastal and shallow water regions. The study will include information on the general oceanic distribution as well. The final product of this study will be contour maps and/or digitally taped data on the distribution of this material to be used for the evaluation of coastal remote sensing methods.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0009, MICROWAVE INFRARED RETRIEVAL

E.C. RIEFENSTERN, Aerodyne Research Incorporated, *Bedford, Massachusetts* (DF244770; F19628-76-C-0135)

AF function - weather analysis and forecasting for military operations. Deficiency - inability to determine meteorological conditions over inaccessible or unfriendly territory. Objective - to develop techniques to better utilize the microwave-infrared vertical probing capability of the Defense Meteorological Satellite. How development contributes - improves the ability to infer and forecast atmospheric temperature profiles. Data collected by the DMSP microwave and infrared sounders will be processed so as to provide accuracy of profiles with minimum computer time. The development activity will allow simulation of advanced sensors for DMSP.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0010, REEFED LAUNCHING SYSTEM FOR LARGE FREE BALLOONS

J.F. DWYER, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF243740)

AF function - advanced balloon systems (surveillance, delivery operations, environmental research support, space equipment test). Deficiency - launching methods for single-cell balloons to carry payloads of 10,000 pounds or more do not exist and recovery systems for this payload weight class are complicated and inefficient. Objective -develop a non-dynamic single-cell balloon launch method and a compatible recovery parachute system for payloads of 10,000 pounds or more. How research contributes - this development will obviate the need to develop advanced balloon platform launchers, eliminate launch forces on single-cell balloons, thereby increasing their capabilities, and provide lower cost and more efficient payload recovery systems.

Balloons will be modified to include a cloth reefing sleeve designed to prevent formation of a sail by constraining the undeployed balloon material until required to accommodate additional inflatant. These balloons will be flight tested, one with a 5000 pound payload and one with a 10,000 pound payload, each using re-entrant top parachutes, proposed as more efficient and less costly recovery systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0011, LINE-OF-SIGHT-CLIMATOLOGY

D.D. GRANTHAM, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF244020)

AF systems using visual or infrared wavelengths for detection and/or tracking, and systems using millimeter-wavelength communication. Deficiency - AF systems designated above have operations which are often inhibited or terminated due to cloud, haze or precipitation interference. Cloud-free line-of-sight (CFLOS) probabilities are needed for AF operational areas. Also, very little quantitative information exists on how often attenuation due to precipitation will effect transmission along microwave - specifically millimeterwave - ray paths at various elevation angles for differing climatic regimes. Objective -(1) To determine probabilities of cloud-free and haze-free lines-of-sight from various aircraft altitudes to earth and to space. (2) To determine joint probabilities of CFLOS at two or more locations spaced up to 400 miles apart, and to prepare a northern hemisphere atlas of CFLOS probabilities through the atmosphere. (3) To determine from radar-scope photography the frequency and extent of precipitation echoes along atmospheric ray paths for elevation angles between 0 and 45 degrees. How research contributes - (1) CFLOS probabilities will aid designers and operators in determining the utility of AF systems. (2) The atlas will depict regions where unacceptable risks of failure are expected. Models of joint probability of CFLOS will be used to estimate the number of targets expected to be simultaneously weather protected and will determine location and spacing of communications sites. (3) The resulting microwave attenuation climatology will aid designers and operators in determining the utility of AF systems, especially for those utilizing low-elevation ray paths because millimeter wavelength propagation is severely reduced even by light rain over long segments of those paths.

A LOS in-flight data collection program will be used to gather clear, cloud- or haze-free line-of-sight observations made by airborne observers in MAC, SAC, TAC, weather recon, Navy patrol squadrons, five NATO countries and two U.S. commercial airlines. These observations are being analyzed to determine clear, cloud-free and haze-free LOS probabilities to the ground, horizon, and sky from various altitudes along flight paths over the northern hemisphere area. (2) In a parallel effort, a model for CFLOS through the entire atmosphere has been developed. (Text abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0012, UV PHOTODISSOCIATION INVESTIGATIONS RELATED TO DISTURBED ATMOSPHERES

R.E. HUFFMAN, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249710)

AF function - communications and surveillance. Deficiency - insufficient information is available regarding extent and duration of blackouts following a nuclear burst or solar disturbance. Objective -provide UV technology needs regarding photon cross-section and UV fireball line absorption. How research contributes - results will be used in computer codes (ROSCOE, WEPH, OPTIR) that predict atmospheric effects for equipment design and military operations.

Investigation of technical problem areas by application of the results of laboratory research and field observations to weapons effects considerations. Photodissociation cross section and rates will be made available for the DNA reaction rate handbook. These rate co-efficients will utilize the cross sections for gases such as molecular oxygen, ozone, molecular nitrogen, nitrogen oxides, water vapor and carbon dioxide. They will be combined with the solar flux in the 120-300 nanometer wavelength region and with model atmospheres representative of several geophysical conditions. From these inputs, the rate coefficients will be generated as a function of altitude. This information will be combined with an updated version of Chapter 13 of the handbook, which only covers photoionization at the present time.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0013, EQUATORIAL IONOSPHERIC IRREGULARITIES MEASUREMENTS

R.S. NARCISI, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249350)

AF function - maintain command control capabilities for Air Force operations in naturally or nuclearly disturbed conditions. Opportunity - the wideband satellite permits propagation measurements during periods of equatorial scintillations. Objective - measure the distribution of ion species during periods of equatorial scintillations to determine the structure and development of small-scale ionospheric irregularities. How research contributes - this effort will provide the first detailed measurements of ionospheric irregularities in conjunction with wideband satellite amplitude and phase measurements. From this, the physical causes of scintillations can be understood to then permit the determination of trans-ionospheric electromagnetic channels for defense communication and navigation systems.

Three positive ion mass spectrometers will be designed and fabricated into three multi-instrumented rocket payloads. These payloads will be integrated into a combined ground and rocket equatorial measurement series conducted with the wideband satellite. The mass spectrometer instruments will measure positive ion composition. These measurements (and other coordinated experiments) will be made during periods of equatorial scintillations and overflight of the satellite. These composition measurements will show, for the first time, the species whose variations are responsible for the equatorial ionospheric scintillations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0014, HIGH-ENERGY PLASMA INSTRUMENT

A.L. PAVEL, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249200)

AF function - AF satellite systems operate at synchronous altitudes where charging can occur due to natural causes and may give rise to effects deleterious to the systems. Deficiency - the data base of the high-energy plasma present at synchronous orbit is inadequate to accurately describe observed charging events or to properly relate them to their ultimate cause. Objective - to provide high-time-resolution energetic particle sensors for the Scatha satellite so as to permit in conjunction with other environmental and engineering experiments aboard the Scatha satellite, the establishment of specifications which support design criteria for space systems. How research contributes - detailed data on the influx of high-energy particles will be available from this satellite and will be analyzed as a function of time, satellite charge, solar illumination and other relevant parameters.

The Magnetospheric Dynamics Branch of the Space Physics Division will provide electrostatic analyzers and solid-state spectrometers for the Scatha satellite. These instruments will define, on a rapid time basis, the influx of high-energy particles to a geosynchronous satellite. A detailed analysis will be carried out on the data from these sensors in conjunction with data from other sensors on the satellite and other appropriate geophysical parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0015, INFRARED CELESTIAL BACKGROUNDS

S.D. PRICE, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF255280)

AF function - target detection, discrimination, early warning, acquisition, terminal guidance. Deficiency - celestial background radiation interferes with operation of airborne, rocket-borne and satellite infrared detection systems. Research - ground-based and rocket-borne measurements of infrared celestial background radiation. How research contributes - this work unit provides observational and theoretical data characterizing the infrared celestial background radiation against which a space-borne target must be detected and discriminated. Thus, it impacts the development of infrared systems to detect target against a space background. Infrared celestial measurements are obtained from ground-based and rocket-borne telescopes in the 1 to 100 micron region. Computational programs and theoretical models are developed in order to reduce, analyze and interpret the observations. The models will be used to define future system needs and the accuracy of the model will improve with improving instrumental sensitivity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0016, SPACECRAFT CHARGING NUMERICAL THEORY

P.L. ROTHWELL, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249040)

AF function - AF satellite systems operate at synchronous altitudes where charging can occur due to natural causes and may give rise to effects deleterious to the systems. Deficiency - the plasma physics interactions responsible for spacecraft charging are not well understood at present and it is necessary to develop appropriate models in order to obtain this understanding. Objective - to develop descriptions of the plasma and energetic particle environment surrounding a spacecraft at high altitude and its spatial and temporal behavior. How research contributes - numerical simulation of plasmas techniques are employed to model the plasma physics interactions of the ambient environment with the spacecraft. Understanding of the interaction and the ability to model sheaths, beams, secondary effects and instabilities will contribute vitally to the solution of the spacecraft charging problem.

A spherically symmetric code has been developed employing a numerical simulation model. The motion of several thousand particles in the field of the spacecraft and their self-consistent field is followed. The code includes the quiet start technique, cloud in cell particle treatment, and distribution function smoothing. Photosheath effects are treated, as well as secondary electrons and electron and ion guns. Quantities calculated are the satellite potential, the sheath structure and the current to the satellite.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0017, AUTOMATED WEATHER FORECASTING

W.R. TAHNK, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF248210)

AF function - weather-sensitive aircraft and missile operations. Deficiency - inadequacy of present short-range forecasts of fixed-base and enroute weather conditions. Objective - develop and evaluate new techniques for operational weather forecasts. How development contributes - provides a rational basis to update and improve the operational effectiveness of weather warnings and forecasts through conversion from manual to automated observing and forecasting systems.

The development program has two phases. The first deals with the establishment of an automated system for 0-3 hr forecasts of cloud base height at fixed-base locations. The techniques will be incorporated into the Modular Automated Weather System (MAWS). The second phase deals with the development of generalized weather forecasting techniques for periods up to 6 hours based upon automated surface observations and geostationary satellite imagery.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0018, PROPAGATION DATA FOR CHARACTERIZING COMMUNICATION CHANNELS

H.E. WHITNEY, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF244730)

AF function - satellite communications. Deficiency or opportunity -inadequate knowledge of the effects of ionosphere scintillations on communications. Objective - scintillation effects for system design. How research contributes - improves reliability of satellite communications.

Multifrequency data will be obtained from transmitting satellites, particularly ATS-6. The data will be analyzed to determine frequency dependence and fade duration and amplitude distributions. Midlatitude studies will use the 84 foot antenna at Sagamore Hill. Radio star data will be taken for correlation with the satellite data. Data from the auroral and equatorial region will be compared with midlatitude data to define geographical differences in the amplitude distributions and fade durations. The scintillation statistics will be related to message length, and modulation characteristics to determine the reliability of satellite communication links and provide design data for overcoming ionospheric scintillations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0019, DESIGN OF SOUNDING ROCKET PAYLOADS

M.J. DAVIN, Wentworth Institute, Undergraduate School, *Boston, Massachusetts* 02115 (DF247640; F19628-76-C-0211)

AF function - reconnaissance, surveillance, communication and advanced weapon systems. Deficiency or opportunity - inability to forecast atmospheric interactions affecting the design and operation of military systems such as re-entry vehicles, over-the-horizon radar and satellite operations. Objectives - (a) to perform research and engineering as required in the design, fabrication and test of aerospace payloads and sensors. (b) to redesign, fabricate, test and evaluate component assemblies of existing aerospace vehicles for the purpose of improving reliability and/or cost effectiveness. How research contributes - the complexities of upper atmosphere and near space in situ measurements demand state-of-the-art expertise if meaningful data are to be retrieved. Improved construction techniques and designs can only enhance reliability of experiments directly related to AFGL projects 2310, 6688, 6690, 7659, 7661, 7670, 8658 and Samso program 2127.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0020, STUDY OF ENERGY BALANCE AND PLASMA MOTIONS IN THE IONOSPHERE

A. DALGARNO, Smithsonian Institution, *Cambridge, Massachusetts* 02138 (DF248310; F19628-77-C-0030)

AF function - surveillance, communication, navigation, ionosphere and magnetosphere modelling. Deficiency - inadequate knowledge of energy balance and plasma motions in the ionosphere for the design of AF communication and navigation systems. Objective - development of theoretical and computational techniques for the calculation of quantities pertaining to the energy balance and plasma motions in the ionosphere including the effects of particle precipitation and electric fields. Satellite measurements shall serve as inputs to the calculations and as a test of the validity of the theory. How research contributes -provides data and analysis essential for the design and maximum utilization of communications, guidance and surveillance systems such as the Defense Satellite Communication System, AF SAT COM II, 414l. The work provides an understanding of the dynamical processes in the ionosphere.

Study theoretical and computational procedures for calculation of energy balance, plasma motions and electrical conductivities on a global basis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0021, VERTICAL SOUNDING ERRORS

W. MOUNT, Geo Atmospherics Corporation, *Lincoln, Massachusetts* 01773 (DF248610; F19628-77-C-0118)

AF function - weather analysis and forecasting for military operations. Deficiency - inability to determine meteorological conditions over inaccessible or unfriendly territory, especially over water. Objective - to develop techniques to improve the accuracy of vertical profiling based on the use of the Defense Meteorological Satellite. How development contributes - improves the ability to infer and forecast atmospheric temperature and humidity profiles from satellite observations.

Operational temperature profiles inferred from DMSP/E package will be compared to coincident radiosonde observations and grid point analysis data. Based on the differences due to clear column decisions, instrument noise and atmospheric transmittance, techniques will be developed to minimize the temperature profiling errors using the operational inversion schemes employed by AFGWC.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0022, THE IMS AURORAL ZONE EAST-WEST MAGNETOMETER CHAIN AND RELATED DATA ANALYSIS

J.S. KIM, State University of New York, School of Arts & Sciences, *Albany, New York* 12222 (ATM76-15612 A01)

The International Magnetospheric Study (IMS) North American magnetometer networks at high latitudes consist of three meridional chains and an east-west chain along the auroral zone. This grant will establish and operate three magnetometer stations in the east-west chain. Together with stations operated by the Canadian Department of Energy, Mines, and Resources, the University of Alberta, the University of Alaska, and the U.S. Geological Survey, the east-west chain extends from 260 degrees E to 350 degrees E geomagnetic longitude. The magnetometer data from the east-west chain and other IMS chains will permit the study of the distribution, continuity, and temporal changes of the auroral electrojets and of other nonelectrojet currents, and magnetic pulsations of various categories. Other correlative studies will be performed in collaboration with investigators who will obtain data from satellites, sounding rockets, balloons, and ground-based observations.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0023, SATELLITE DENSITY ACCELEROMETER

W. LANGE, Bell Aerospace Company, *Buffalo, New York* 14240 (DF242380; F19628-74-C-0114)

AF function - airborne surveillance, target acquisition. Deficiency - atmospheric density variations with time and space cannot be accurately predicted. Research - direct density measurements with satellite-borne accelerometers. Results are correlated with solar and geophysical parameters. How research contributes - permits development of accurate density forecasting techniques. The objective of this work is to develop and fabricate three flyable omnidirectional atmospheric density accelerometer systems. The instrument will be flown on a future Air Force low-altitude satellite. Atmospheric density is determined from measurement of the satellite deceleration caused by aerodynamic drag. It is anticipated that measurements will be made at altitudes from about 130 km to 400 km.

A satellite accelerometer flight unit with a single proof mass which is sensitive along three orthogonal axes will be developed. This will be accomplished by modifying the electronic design of a single-axis accelerometer presently used for satellite measurements. The proof mass is to be supported by electrostatic forces. An applied force causes the proof mass to tend to move in a direction opposite to the applied force. Measurement of this applied force along any axis is accomplished by determining the electrostatic forces which are required to recenter the proof mass. Extremely sensitive and accurate measurements of aerodynamic drag forces are made possible using this technique. The measured drag is directly proportional to atmospheric density. Three of these omnidirectional accelerometer systems will be developed, fabricated and tested. They will be flown on low-altitude satellites planned for launch in CY 1977 and 1978. The results are required for improved satellite navigation and for the development of improved atmospheric models for more accurate prediction of satellite orbits.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0024, REMOTE-SENSING PHOTOGRAMMETRIC SURVEY FOR LONG-TERM SHORELINE EROSION INVENTORY, R.I. COAST

J.J. FISHER, Univ. of Rhode Island, School of Arts & Sciences, *Wakefield, Rhode Island* 02881 (R/E-9)

Long-term rates of shoreline changes (erosion and accretion) will be measured photogrammetrically from vertical aerial photographs of the R.I. coastline that have been taken of the past 36 years (1939-1975) in a series of 12 flights. These measurements will enable one to determine long-term changes over a wide coastal area. Application of special photogrammetric techniques including enlargements rectified to a common scale, field surveys control for scale determination and measurements using optical photogrammetric tools will enable mapping of shoreline position to a location position of one foot or better than one half meter. High tide, still water, and dune-like changes will be measured on sequential photographs. Analysis of spring and fall photography will enable determination of short-term seasonal changes as well as long-term changes. Several hundred photogrammetric reference points would be established in this inventory network. A nominal computer program will be used to store, calculate and retrieve the data from the several thousand sequential photogrammetric survey points.

ANTICIPATED BENEFITS: Final erosion-accretion-shoreline trends in a computer print-out map format will be used to indicate beach areas possibly suitable and unsuitable for development and to suggest design setback limits. For general presentation, these long-term erosion/accretion shoreline changes will also be graphically mapped on the individual barrier beach area maps that appear in Volume 11 of the URI Coastal Resources Center's study of 'Rhode Island's Barrier Beaches.' Present need of information on long-term shoreline changes for this site is for specific planning for barrier island housing construction, nuclear power plant siting and recreational beach use. Similar planning needs are to be found along all New England coastlines and the information and techniques developed along the R.I. coast in this project can then be applied elsewhere.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Sea Grant Office

5.0025, GEOMETRICAL AND GEODYNAMICAL STUDIES IN EUROPE WITH TWO-FREQUENCY DOPPLER MEASUREMENTS FROM SATELLITES

E. TENGSTROM, Univ. of Uppsala, *Uppsala, Sweden* (DF289430; AF-AFOSR-2849-75)

AF function - research in geodesy, satellite tracking. Deficiency - the U.S. has a network of Doppler receiving stations capable of determining the ephemeris of numerous satellites. There are many satellites the U.S. cannot obtain accurate ephemeris data on because of the location of its network of Doppler receiving stations. Research -this effort is part of an international project sponsored by the Council of Europe Working Group on Geodynamics to establish the capability to measure ephemeris of various orbiting satellites. It is of interest to both the Defense Mapping Agency and the U.S. Navy Weapons Laboratory. How research contributes - if the Europeans develop the capability to determine accurate ephemeris of satellites they could contribute valuable data on satellites which are out of range of the U.S. network.

Simultaneous Doppler measurements of several satellites will be recorded, the data reduced and the ephemeris compared with data from the U.S. Navy Weapons Laboratory.

SUPPORTED BY U.S. Dept. of Defense, Air Force, European Office of Aerospace Research & Development

5.0026, NAVY ENVIRONMENT - MICROSCALE STRUCTURE OF THE BOUNDARY LAYER BENEATH THE AIR-SEA INTERFACE

K.B. KATSAROS, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (DN223057; N00014-75-C-0502)

Proper interpretation of remotely-derived infrared sea surface temperature (SST) images requires a knowledge of the thermal structure of the boundary layer extending beneath the sea surface, and how this thermal structure depends on the fluxes of heat and moisture (which themselves depend on parameters such as air-sea temperature difference, wind speed, evaporation and precipitation, etc.). This information is needed if the Navy is to more fully understand the limitations and capabilities of remotely-derived SST images, which themselves are needed for observing and forecasting the influence of fronts and eddies on ASW problems. The objective of this task is to study the microscale structure of the upper-ocean boundary layer and its dependence on the fluxes of heat and moisture across the air-sea interface.

The momentum, heat, and moisture fluxes across the air-sea interface are examined theoretically, experimentally, and in the field. Earlier theory is being tested in the laboratory using microsensing equipment approaching the water surface from below in order to avoid meniscus (surface tension) effects. Field instru-

ments are being developed in order to test the general applicability of the theoretical and lab results to open ocean conditions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, A-10 TRAINING RESEARCH SUPPORT

L.E. FOGARTY, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF223450)

To modify cockpit A of the Advanced Simulator for Pilot Training (ASPT) to an A-10 configuration to provide a tactical weapons delivery capability, heads-up display, A-10 flight and weapon scoring in support of transition training research and air-to-surface research capabilities.

The necessary hardware modifications will be performed on-site under the ASPT maintenance contracts. The flight dynamics for the A-10 will be developed under a joint in-house/contractor effort. The A-10 project has been segmented into two phases. Phase I addresses the modifications required for transition training/research and should be completed in the first quarter of FY 78. Phase II will provide the capability for air-to-surface research and is scheduled to begin 1 Jan 78. Efforts in phase II will refine the ASPT handling characteristics to approximate the A-10 performance as closely as possible. This phase will continue for 12-14 months.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0002, A STUDY OF ASUPT PREPROGRAMMABLE FLIGHT DEMONSTRATION CAPABILITIES

M. NATAUPSKY, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF222050)

To compare and evaluate the instructional potential of the advanced instructional provisions (AIP) available on ASUPT and to define the optimal use of instructor pilots in conjunction with AIP.

UPT preflight casual students at WAFB will be trained in ASUPT on standard ATC maneuvers under one of three experimental syllabi comparing the conventional student-IP instructional techniques with ASUPT's preprogrammable maneuver demonstrations. The students will be required to meet IP-established criteria recorded by the advanced instructional provisions performance measurement feature of ASUPT.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0003, COST ANALYSIS OF ASPT CLASS VISUAL AND MOTION SYSTEMS

M.E. WOOD, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF223130)

To develop cost factors and associated cost estimates for the visual and motion systems associated with ASPT class simulators. These data will be combined with ASPT motion/visual training effectiveness research to provide a basis for cost-effectiveness analysis of future simulator systems, e.g., an advanced version of ATC's instrument flight simulator (IFS).

Using both the cost-factors approach and parametric analysis, life cycle cost (i.e., R&D acquisition and O&S) estimates will be obtained for four major ASPT class motion/visual configurations: (1) full platform motion and full (ASPT) field-of-view, (2) full platform motion and narrow (ATC/IFS) field-of-view, (3) no platform motion and full field-of-view, and (4) no platform motion and narrow field-of-view. Full platform motion and full field-of-view (7 CRTs) are represented by normal ASPT configuration while the narrow field-of-view, the present ATC/IFS visual system, is simulated by using only one of the ASPT CRTs. This costing study will parallel a training effectiveness research effort which considers the four motion/visual configurations cited above (W.U. 1123-03-28). Data from both studies will be combined in a cost-effectiveness analysis of the four motion/visual configurations. Standard manufacturer's prices, cost factors manuals data, and data from other sources (including CERS) to develop LCC estimates.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0004, PULMONARY GAS FLOWMETER FOR ABNORMAL ENVIRONMENTS

W. PATAPOFF, Perkin Elmer Corporation, *Pasadena, California* (DF320600; F33615-77-C-0607)

The purpose of this effort is to obtain a bi-directional respiratory flowmeter that will accurately monitor inspired and expired gas flow rates and volumes under dynamic conditions of increasing gravitational forces and varying altitude experienced by aircrew members. Currently available flowmeters are either affected by dynamic variation in g forces, pressure, gas density, gaseous species, temperature or humidity. This produces large and unacceptable errors when evaluating environmental stressors on aircrew members. The present procurement contract seeks to overcome these errors by the use of new technology in this area. Use of the flowmeter will provide, more accurately, data on the effects of the stressors met in flight and for establishing biomedical criteria for the design and testing of life support systems.

The contractor shall furnish the necessary personnel, service, equipment and facilities to design, fabricate, test and deliver a pulmonary gas flowmeter for measuring pulmonary function under aircraft flight-simulated conditions of changing pressure and gravity fields. The contractor will build a 'breadboard' model which will be tested and approved by USAFSAM before the final model is fabricated, tested and delivered.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0005, LEVEL OF ALERTNESS AND THE PERCEPTUAL PROCESSING OF VISUALLY DISPLAYED INFORMATION DURING SIMULATED FLYING MISSIONS

K.C. SCHWANK, U.S. Air Force, Behav. Sci. & Leadership Dept., *Colorado Springs, Colorado* 80840 (DF281910)

AF function - to identify through literature search and study the effective visual information processing during simulated flying factors which are most influenced by fluctuations in level of alertness. To develop research protocol which will examine psychological and physical stresses which degrade these facets of visual information processing. Deficiency - aircraft losses due to loss of alertness. How research contributes -provides vital data on factors affecting alertness.

Simulated flying missions of varying complexity will be performed while arousal level would be manipulated via fatigue, ambient noise levels, and/or psychological stresses. Patterns of visual search will be monitored to determine how scanning and attention to relevant and irrevelant sources of information are affected.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Frank J. Seiler Research Lab.

6.0006, HUMAN BREATHING/METABOLISM SIMULATOR

R.G. BARLETT, Roscoe Bartlett & Associates, *Frederick, Maryland* 21701 (DF319360; F41609-75-C-0029)

Accurate testing and evaluation of respiratory life support concepts and equipment requires a continuous monitoring and simulation capability. Enhancement of human safety and acquisition of more meaningful performance information can be accomplished with the use of a metabolic simulator designed to mimic human function corresponding to variable states of stress. Peripheral control of such a simulator should be interfaced to provide long-term programming of specific test sequences. Physiologic conditions including hyperventilation and acute exercise response should be attainable on a simulated basis, with appropriate attachments provided for oxygen regulators and masks during exposure to altitude. A remote controller should also provide a tape playback and control facility to enable simulation of

actual inflight situations as recorded by the inflight physiological data acquisition system.

A human breathing/metabolism simulator will be constructed to provide the following component stages- (1) breathing simulation providing rate, volume, residual, and waveform control, (2) humidity and temperature simulation providing expired gas control comparable to anticipated human function, (3) oxygen consumption and carbon dioxide production at levels representative of normal human range and expected extremes, and (4) a remote control and monitoring assembly providing fully automated operation of the complete simulator assembly.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0007, PROCEDURE TO PREDICT AIRCRAFT NOISE IN COMMUNITIES

D.E. BISHOP, Bolt Beranek & Newman Inc., *Cambridge, Massachusetts* 02138 (DF320240; F33615-77-C-0528)

Noisemap is a fully computerized procedure for predicting the noise exposure produced by the multiplicity of aircraft flight and ground runup operations at an air base. Noisemap is the methodology officially used by the air staff for preparing/assessing environmental noise impact and conducting compatible land use planning studies. The objective of this research is to insure Noisemap remains the state-of-the-art tool for predicting noise exposure about air installations.

The contractor will conduct detailed analytical studies and development work to refine and update the community-aircraft noise exposure (Noisemap) predictive model. Areas of investigation include improving the overall operating efficiency, application guidelines, and excess ground attenuation models. The contractor will determine the feasibility of expanding Noisefile and Noisemap to include helicopter operations. The contractor will develop a detailed test protocol for improving the current model used for excess sound attenuation. Studies will be made to determine the practical engineering and economical problems inherent in developing and applying demographic and compatible land use overlays with Noisemap as indices of relative environmental noise impact.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0008, ASSIGNMENT OF SUBJECTS IN ASUPT EXPERIMENTS

D.R. PEW, Bolt Beranek & Newman Inc., *Cambridge, Massachusetts* 02138 (DF222190; F41609-76-C-0008)

To select and validate a set of tests of human information processing capabilities and job sample measures for their utility in estimating success in pilot training and to use these tests as the basis for matching and/or stratifying the sample of subjects to be used in ASUPT experiments.

Efficient use of the ASUPT simulation facility for experiments on the training effectiveness of various simulator configurations requires sophisticated methods of subject matching and stratified sampling in order to minimize the time and number of subjects required in each experiment. Matching procedures, however, require having tests that correlate with criterion performance. The quantitative performance scores obtained from these tests would be used as predictors for selecting, matching and/or stratifying the trainee sample to be used. The proposed battery would incorporate only a few tests, they would be designed to be portable and easily administered during a period of one to two hours.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0009, A FOUNDATION FOR SYSTEMS ANTHROPOMETRY

H.M. REYNOLDS, Univ. of Michigan, Graduate School, *Ann Arbor, Michigan* 48104 (DF044140; F44620-76-C-0115)

AF function - in day-to-day operations, aircrew members are exposed to a number of dynamic situations such as being subjected to maneuvering forces (g), buffeting, and vibration. A new anthropometry which takes into account such dynamics in the design and operation of crew stations is required. Deficiency - conventional anthropometry provides static dimensions measured on subjects rigidly posed in highly standardized positions, and does not meet requirements for describing body motions in dynamic situations. Objective - a three-dimensional systems anthropometry will be developed which treats the body as a dynamic system. The model will optimize the number of links needed for description of body movement and mobility for workspace design and acceleration/deceleration/simulations. How research contributes - the lack of such an anthropometric system is a significant road block to providing criteria central to the design of sophisticated human analogs, both physical and mathematical. This basic human engineering research program will lay the required foundation for using new anthropometric systems which are in sight in the near future.

A means of spatially identifying anatomical and anthropometric landmarks suitable for three-dimensional coordinate description will be developed. Procedures are being developed specifically to define external morphology, internal skeletal geometry and coordinate systems, and also provide a means of relating the new anthropomechanic data to the extant classical anthropometric data. Phase II will provide the methodology necessary to describe the human anthropomechanic system for one body region--the lumbar/pelvic/femur linkage system. Similar research on the thorax, shoulder, neck and appendages will be suggested in the phase II final report as a continuation to an understanding of the whole body.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0010, INVESTIGATION OF RELATIONSHIPS BETWEEN CREW RESTRAINT DESIGN CRITERIA AND IMPACT INJURIES

C.F. ACEVEDO, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF322360)

USAF accident investigations reveal that major injuries and fatalities may be related to the ineffectiveness of the personnel restraint systems under emergency escape or aircraft crash conditions. For example, operational statistics and aeromedical analysis have shown that the high spinal fracture rate (42 percent) occurring during use of the F-111 crew escape module is probably related to the geometry of the restraint system and ballistic inertia reel. Although design criteria are available they are often disregarded since their relationships to crew injuries are seldom quantified. The objective of this research effort is to determine the injury pathology associated with a specific impact protection system's design criteria. These criteria pertain to restraint system geometry, restraint tie-down points, webbing materials properties, load distribution and integral impact attenuation.

The injury potential associated with specific restraint systems will be experimentally evaluated using a subhuman primate. A baseline for comparative evaluation of protection systems will be established by conducting impact tests using the standard USAF lap belt and shoulder harness geometry published in current design specification handbooks. Impact injury pathology will be assessed using the AMA Abbreviated Injury Severity Index. Other restraint systems that are operational or in the conceptual design phase will be similarly tested to identify unique injury modes and to compare the severity of the observed injuries with those of the baseline protection configuration. Data collected under this work unit will also be used to provide methods for predicting impact injury severity using mathematical models.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0011, SCANNED LASER VISUAL DISPLAY SYSTEM DEVELOPMENT

D.W. ANDERSON, U.S. Air Force, Human Resources Laboratory, *Dayton, Ohio* 45433 (DF228300)

To develop a design for a wide-angle, multi-viewer infinity display system for use in visual simulation. Current multi-viewer display systems provide a relatively narrow field-of-view. State-of-the-art wide-angle displays are limited to only one viewer. With this effort, the technology to provide a continuous wide-angle,

color infinity image to the cockpit crew in a flight simulator will be investigated. A display system based on the initial design effort is intended to increase the number of missions which can be trained in simulators for bomber, cargo, and tanker-type aircraft. The purpose of this work unit is to document the in-house portion of the R&D.

A scanned laser visual system is presently being developed by the Army Training Device Agency under contract. The system has the potential to solve many of the problems associated with wide-angle, multi-viewer displays. Funds will be transferred to the Army to allow the expansion of the current contract effort to study and design a special optical element (SOE) which is the key element in creating an infinity display making use of the high-intensity raster scanned laser. Samples of various types of potential SOE's will be procured to facilitate study of manufacturability and choice of final design. In addition, a study will be made of modifications required in current computer image generators to permit interface with the scanned laser visual display system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0012, BODY SIZE AND MASS OF AF PERSONNEL

C.E. CLAUSER, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF320940)

To describe body-size distributions of AF personnel for: (1) guiding the design, sizing, and procurement of personal-protective equipment and clothing and the layout of work stations, (2) establishing relationships between body size and injuries incurred upon ejection, and (3) developing human mass distribution and body-size criteria for the design of human analogues required to simulate the body's response to impact, ejection and windblast forces.

The anthropometric data base of USAF men and women required for guiding the design, sizing, and procurement of personal-protective equipment and clothing will be updated in FY 77 for establishing relationships between body-size and injuries incurred during the ejection sequence. In FY 77 and 78, advantages will be taken of recently developed biostereometric techniques to determine for the first time mass distribution characteristics of a sufficient number of living human beings to be able to describe variability of these parameters in the USAF male population. Emphasis is placed upon developing procedures for improving the efficacy with which anthropometric data can be applied to the design of AF systems and equipment. This effort was formerly documented under work units 71840803 and 71840807.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0013, PERFORMANCE MODEL OF REPETITIVE G EFFECTS ON AIR COMBAT EFFECTIVENESS

W.H. INGE, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF322540)

Primary objectives are: (a) to obtain data on human operator performance during and following exposure to repeated high-g stress, (b) to measure associated physiological parameters, and (c) to formulate a model of human operator performance under repetitive acceleration in order to predict operator effectiveness in high-performance aircraft under combat conditions. These objectives are part of an ongoing USAF effort to examine air-to-air combat tracking scenarios and mathematically describe the human pilot in order to improve fighter tactics and aircraft design (TAC Avenger).

Human subjects will be exposed to standard repetitive g profiles on the AMRL dynamic environment simulator in a closed-loop tracking task. Their tracking errors during the task will be recorded to provide modeling data. Several standard stress-related physiological measurements will be made, including pulmonary function tests, blood chemistries, and blood formed elements. The results will be examined for clues to physiological mechanisms related to performance decrements under acceleration stress.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0014, ENVIRONMENTAL DEGRADATION OF AIR FORCE CHEMICALS IN AIR, WATER AND SOIL

R.C. INMAN, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF320520)

To study the degradation of Air Force critical materials when introduced into an aquatic or terrestrial environment. Propellants and fuels are currently being handled in a variety of programs from development studies through operational launches. In the course of these programs, some of these chemicals may be released into the environment by the venting of fuel systems, the dumping of scrubber system waters, inadvertent spills or aircraft accidents. The persistence of a chemical in the environment is a necessary part of any chemical hazard assessment to an ecosystem. Factors which alter compound degradation rates must also be identified in order to adequately manage accidental aquatic or terrestrial spills and to provide information for safe disposal or decontamination of the agent.

Initially, degradation rate kinetics will be determined in soil and water. The degradation products will be identified to discount the possibility that they do not present a more significant hazard than the parent compound. Then, those factors which alter the compound degradation rates will be investigated. This information along with the data derived on any given chemical under other environmental effects studies will then be used in compiling environmental impact statements or assessments on weapons systems employing these chemicals. The complexity and variability of aquatic and soil systems will require continuing methodology development in order to provide viable data used over widespread geographical areas.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0015, NOISE DOSIMETRY AND TYPICAL NOISE DOSES

D.L. JOHNSON, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321280)

Various personal noise dosimeters are available on the commercial market; however, no systematic study of their merit and shortcomings has been accomplished. At the present time the AF does not use noise dosimetry to assess personnel noise exposure. It is essential to evaluate this technical concept to determine if it has a place in the AF hearing conservation program to recommend what the role of noise dosimetry should be. The objectives are: to evaluate the application of personal noise dosimetry in Air Force environments, to determine the typical noise exposure of Air Force personnel in order to define typical occupational and non-occupational noise exposures, and to assess typical noise exposures relative to allowable exposures as specified in AFR 161-35. This work will be coordinated with the USAF Surgeon General and with base-level bioenvironmental engineers as well as the US EPA which will provide joint funding on the effort.

The approach will involve the use of personal noise dosimetry by Air Force personnel at various bases, with different AFSCS during both on-duty and off-duty hours. The selection of participants will insure that various degrees of noise exposure will be investigated. The noise exposures measured by the dosimeters will be compared to exposures described by the predictive methods now in use. Results will be used to verify the predictive methods now in use, to determine the role of personal dosimetry in the AF, and to determine the reasonableness of the safe 24 hour noise exposure limits currently identified by the EPA.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0016, VOICE COMMAND SWITCHING

D.F. MCKECHNIE, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321160)

Human factors research has been involved with the efficient use of man's visual, auditory, and coordinated motor skill in crew stations. Increases in demands upon the eye/hand workload in crew stations lead to investigation of other means to carry out that function. A potential method for accomplishing the functions, heretofore defined as eye/hand, is the use of voice actuated switching or input coupled with voice feedback for verification. Development of voice or speech recognizers and synthesizers now

permits them to be considered for switching systems. The use of the voice recognition and synthesis systems to control the B-52 EWO Electronically Steerable Antenna System (ESAS) after failure of its automatic driving capability will be investigated. Successful application of these voice systems may directly enhance the mission success.

An interface of the ESAS drive system will be accomplished in the EW simulator. Mission requirements, tasks, and scenario will be developed to allow the EWO to maintain antenna tracking through verbal commands while accomplishing his other EWO tasks. Comparison of the operator's accuracy and time to perform these duties with and without the voice command system will be evaluated. Acquisition of the voice synthesizer, interfacing of the recognizer after ESAS installation, vocabulary selection and command structure all impact scheduling. All but the actual tie to the SW simulator can be initiated immediately. January 1977 is the projected date for system checkout and scheduling.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0017, MANUAL CONTROLLER DESIGN AND EVALUATION

D. MONK, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321050)

The original objective of this work unit was to evaluate conventional and developmental controllers. The updated objective is to determine how well subjective estimates of performance reliably and validly predict actual performance in a manual tracking task. Given a reliable and valid means for predicting performance from subjective estimates, the original objective will be pursued as a follow-on effort.

Human reliability in a manual tracking task is evidenced by staying within prescribed limits. Ledbetter and Cramer have studied the properties of level crossings for Gaussian processes and have shown that the stream of crossings approaches a Poisson distribution as the limits are relaxed. This implies the time between crossings should be distributed as a negative exponential. Subjects will be asked to perform a compensatory tracking task (crudely analogous to aerial refueling). Task dynamics will be selected to assure linear system performance. A Gaussian perturbation will be introduced to drive subject performance. Levels of perturbation will be determined by appropriate selection of the second spectral moment, which is known to determine the probability of level crossings. This provides a basis for predicting not only the number of level crossings but the time between crossings as well. Correlational techniques will be used to study the reliability of subjective estimates, and regression will be used to demonstrate how well subjective estimates of these parameters actually predict performance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0018, STUDY EXCESS SOUND ATTENUATION (ESA) AND DEVELOP ESA MODEL WITH RESPECT TO AIRBASE/COMMUNITY NOISE

R.G. POWELL, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321410)

The noise produced on-base and in communities by Air Force airbase operations is a major environmental concern. The airstaff, majcoms, and airbases assess the impact of such noise by applying community noise predictive models (i.e., Noisemap) and noise data (i.e., USAF Bioenvironmental Noise Data Handbook, Noisefile) developed by AMD/AMRL under work units 72310418, 24, 25, 28, 31, and 33. The accuracy of these predictive models and data depend in large part on the accuracy of the alogrithms used to account for excess sound attenuation (ESA) caused by reflection/absorption of sound by the earth's surface/ground cover (e.g., sand, grass, crops), scattering caused by wind turbulence, obstacles (e.g., buildings, trees), and other factors. Although the ESA model presently used is the best available, it has significant uncertainties which cause corresponding uncertainties in the environmental noise assessments. The objective of this work unit is to develop better models for more accuractely predicting ESA in forms suitable for practical implementation in Noisemap, the handbook, and Noisefile.

AMRL will conduct airbase noise measurements over a 1-2 year period using 6-10 all-weather acoustic measuring stations. Data taken will define ESA over a range of 75 m to several kilometers from the source for all times of day/night, all seasons, various weather conditions, and for flat farm land and urban/suburban areas. Statistical analyses will provide the basis for new empirical ESA models which better define such attenuation for specific classes of conditions (e.g., day/night, rual/suburban, summer/winter).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0019, ANTHROPOMETRIC DATA FOR PILOT PERFORMANCE/SAFETY

E. CHURCHILL, Webb Associates Incorporated, *Yellow Springs, Ohio* 45387 (DF318270; F33615-77-C-0503)

To provide engineering-anthropometric data required to guide the design of cockpit and other work-station geometries and the design, sizing, and evaluation of personal-protective equipment for AF men and women, and to provide mass distribution data to guide the design of human analogues to simulate the body's response to hazardous environments.

Statistical techniques are developed to estimate reliably from small sample studies percentile distributions of anthropometric and biomechanical data. Mass distribution characteristics of living male subjects are obtained by stereometric techniques and are related to their anthropometry for developing AF population statements of these characteristics. The latest anthropometric data of AF women are used to develop sizing programs and systems for guiding the design of head/face protective gear for AF women. The latest anthropometric data of Air Force men are used to guide the design and evaluation of chemical warfare protective assemblies.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0020, PILOT PERCEPTION AND PERFORMANCE MEASUREMENT

P.R. KRISHNAIAH, Univ. of Pittsburgh, Graduate School, *Pittsburgh, Pennsylvania* 15213 (DF140650; AF-AFOSR-3239-77)

Part of AFFDL's responsibility is the development of advanced flight control systems and crew stations. The use of electrooptical, multi-function controls and displays in advanced crew stations places many new demands upon the pilot's visual and information processing channels. In addition, in order to compare candidate flight control systems and crew station components, simulations and flight tests are conducted in which pilot performance is measured. However, there is no single measure of pilot performance, thus requiring the collection of many kinds of performance data and their analysis by means of multivariate statistical techniques. The objective of this work effort is twofold: (1) to examine visual information processing techniques employing fast Fourier transforms, and (2) to evaluate available multivariate statistical techniques for simultaneous comparison of mean vectors and the development of computer programs to implement these techniques. Objective 1 will result in optimized symbol formats for electrooptical displays in advanced crew stations. Objective 2 will provide a means of determining which of the candidate crew stations/flight control systems is best for the pilot.

Objective 1- automatic pattern recognition techniques will be employed to evaluate symbol confusability both within and between symbol sets. Objective 2- seven currently available multivariate statistical techniques will be evaluated by the contractor as to their robustness to violations of the assumptions of homogenity of the population covariance matrix and the normality of the multivariate distribution. The most robust technique will be implemented by means of computer programs which will be available for use by AFFDL personnel.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

6.0021, G-RELATED PATHOLOGY IN AF PERSONNEL EXPOSED TO HIGH-G STRESS

K.K. GILLINGHAM, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF319710)

To determine pathologic and pathophysiologic responses of pilots and other personnel exposed to high g forces of the type to be experienced in operational fighter aircraft of the 1980s.

Human subjects exposed to high-g stress on the USAFSAM Human Centrifuge during experimentation under other work units will be given prestress and poststress examinations designed to elicit evidence of resultant strain or physical damage. Non-invasive cardiac evaluation using VCG, echocardiogram, treadmill stress testing, and serum isoenzymes will be emphasized. Invasively and noninvasively obtained physiologic data, such as arterial pressure and oxygen saturation, will be obtained from human volunteers during centrifugation, to evaluate and describe the cardiovascular, respiratory, and metabolic changes that occur during high-g aerial combat maneuvering; incidence of g-related pathologic changes in operational aircrew will be studied via compilation of anecdotal and epidemiologic data from fighter pilots and base flight surgeons. This work unit continues some efforts begun under work units 7930-13-09 and 7930-13-10, which have been terminated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0022, MATH MODELS IN S/V ANALYSIS

P. RAYFORD, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF315760)

Operations personnel, strategic/tactical planners, weapons analysts and system designers need to be able to accurately predict the impact weapons radiation has upon aircrew performance and subsequent mission success. Our objective is to develop, refine, verify and exercise mathematical models of operator-machine interaction and experimental animal-to-man extrapolations for purpose of S/V analysis of manned AF operational systems, to conduct in-house and contractual research in the definition and measurement of model input parameters, to perform mathematical and statistical analyses of the precision and accuracy of model output, to utilize resultant models in meeting requirements posed by using commands, weapons analysts and System Project Offices.

The development of a model of the manned aircraft in a nuclear environment considers the aircraft aerodynamic and control characteristics, atmospheric turbulence, terrain (for low-level flight), interaction with other aircraft (for refueling), human performance capability under such stressors as fatigue, task complexity, vibration, and ionizing radiation, and scenario-dependent factors such as mission duration, workload, and nuclear threats. The model is expected to be relatively complex and in the form of a user-oriented computer code. It would have a high degree of flexibility and could provide estimates of the probability of mission completion for many and various combinations of human and/or system performance degradation, adverse weather conditions, equipment failures and threats encountered.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0023, IN-FLIGHT EVALUATION OF COCKPIT THERMAL ENVIRONMENT

R.E. RYAN, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322670)

Air Force operations expose personnel to a wide variety of thermally stressful conditions both in flight and on the ground. Accurate measurements of field conditions are necessary to provide a data base to determine the adequacy of environmental control systems and individual thermal stress protective garments. Previous accomplishments in this area are documented under work unit 7164-17-23. This work unit is being established to implement a new technology objective as directed by HQ Aerospace Medical Division. Application of data base obtained from this work unit is being performed under work unit 7930-12-04.

Unique, USAFSAM-developed instrumentation will be used to record dry bulb temperature, dew point, air flow, black globe temperature, heart rate, body core and multiple skin temperatures. In-flight data will be obtained from experimental aircraft stationed at Edwards AFB and operation aircraft located in thermally stressful areas of the United States.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0024, TEST AND EVALUATION SUPPORT TO ADTC AEROSPACE GROUND EQUIPMENT

R.E. RYAN, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF323350)

This effort provides expertise and instrumentation to determine the quality and build-up of exhaust gases in and around aerospace ground equipment (AGE) during DT&E at ADTC, Eglin AFB FL. Human engineering/crew technology support to ADTC is coordinated with AMRL through AMD.

Trace gas analyzers capable of detecting carbon monoxide, nitric oxide, nitrogen dioxide, and hydrocarbons are used to measure exhaust gas concentrations in the most typical operating environments of AGE.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0025, AIRCREW SYSTEM OPERATOR PERFORMANCE SIMULATION

D.M. SCHOLL, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF321560)

An essential component for any survivability/vulnerability (S/V) assessment of manned USAF systems is a reasonable estimate of the likelihood and severity of performance decrement that aircrews might suffer when exposed to weapons radiation in operational environments. The objective is to provide data from which such reasonable estimates can be derived. Nonhuman primates, trained to perform visual tasks, analogous to aircrew duties in both their type and scheduling, will be examined performing under conditions of radiation alone or radiation combined with other environmental stressors. The measurement of primate performance in such situations will allow more accurate prediction of human aircrew performance by supplying necessary data to currently developing mathematical models of manned system S/V.

By employing established psychological procedures, nonhuman primates will be trained in existing analogs of complex aircrew duties and in new tasks to be developed. The tasks will require considerable attention/vigilance to visual stimuli of both continuous and intermittent varieties. Continuous performance in compensatory and pursuit visual tracking tasks will be used to simulate aircrew tasks such as the navigational duties of an offensive system operator (OSO). Detection of signals in various levels of noise will simulate pilot, OSO, and other aircrew members requirements to monitor instrumentation. Primate short-term memory for visual stimuli will provide some basis for predicting decrement of crew member psychological functions beyond simple perceptual-motor skills. Radiation exposure and additional stressors will be designed to fit hypothetical operational situations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0026, SUPPORT TO OTHER DOD AND US GOVERNMENT AGENCIES AND CIVILIAN ORGANIZATIONS

D.H. SPOOR, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322010)

The objective of this work unit is to provide direct support to requestors for assistance through utilization of the existing aerospace medicine technology data base, the expertise of the Clinical Sciences Division staff, and where required, the expertise of USAFSAM resources outside of Clinical Sciences Division.

The approach to be utilized will involve initial Division staffing of the specific request to determine the full spectrum and scope of the endeavor, the individuals to participate in the evaluation, and the assignment of OPR to a Specific Clinical Sciences Division scientist. All available Division resources will be subject to utilization at one time or another including the various medical information files, the accumulated patient evaluation records

from the Aeromedical Consultation Service, and also the accumulated years of aeromedical experience and judgment. Anticipated products will be summary of evaluations and analyses which may be in a simple letter reply, a USAFSAM technical report, or published paper. This is a new-start work unit for FY 77.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0027, MISSION-CREW EMPLOYMENT PROCEDURES AND SYSTEM EVALUATION FOR RIVET JOINT
W.F. STORM, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322190)

The primary goals of USAFSS rivet joint modernization are (1) to better interface with tactical command control communications (C3) elements by closing the tactical loop communication system and (2) to improve manpower utilization. Both goals are accomplished through use of automated, computerized search and acquisition systems. These new systems permit more airborne time for data analysis and intelligence production. They also require new modes of operation, new skills, and increased workloads for the mission crews. Baseline data are not available on the ability of operators to manage the modernized, high-speed, console stations. The objective of this work unit is to determine the psychological and physiological stresses on the mission crewmembers due to environmental conditions and interaction with the new system. Equipment/console design, crew accommodations, and environmental conditions of the aircraft will also be evaluated.

This evaluation will employ the USAFSAM stress battery, relying on behavioral and physiological indices to determine operator/crew rest requirements and crew performance problems related to in-flight environment and workload. Using questionnaires and critical incident surveys, the suitability of equipment location for use and repair will be determined, configurations which are injurious to crewmembers during stable and/or unstable flight will be identified, and comfort/fatigue factors such as temperature, noise, and vibration will be evaluated. Portions of this effort were previously documented under 7930-09-11 and 7930-10-06.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0028, VISUAL STANDARDS
T.J. TREDICI, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF321770)

Aircrew must be able to maintain continuity of vision in their operation of manned aerospace vehicles. Review and update of the visual standards for entry and retention in the flying specialties is essential to insure visually qualified members in sufficient numbers capable of performing the mission.

Liaison with the Army and Navy on visual standards for aircrew will be maintained, and coordination with FAA on standards for category classifications of commercial pilots will be on a continuous basis. Dynamic stress effects on the visual system will be investigated. Ocular aging will be studied to assure proper physical standards criteria, therapy, and/or prevention. Efforts previously under work unit 7755-09-04.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0029, CONTACT LENSES AND KERATOCONUS
T.J. TREDICI, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF323030)

The objective of this work unit is to evaluate and follow selected USAF aircrew personnel with visual disorders, principally corneal, requiring contact lenses to maintain their visual function. Particular emphasis will be placed on those individuals with irregular astigmatism and keratoconus. This work unit will also include a group of individuals who prior to entering flying training had refractive errors altered by a technique known as orthokeratology. A small number of patients who underwent this form of 'treatment' and who appear to be developing a corneal dystrophy (keratoconus) have now been identified. The possibility has to be explored that this may have been hastened or caused by the orthokeratology procedure. The permanence of this procedure (alteration of the refractive error) has been questioned and therefore follow-up examinations might better help in answering these questions.

Patients to be included in this study will be identified primarily from referrals to the Aeromedical Consultation Service from base-level flight surgeon's offices Air Force-wide and to a lesser extent from majcom and HQ USAF referral. Referral will usually be based on the fact that the patient cannot be corrected to 20/20 visual acuity with spectacle lenses. The scope of each evaluation will be dictated by those elements indicated from the patient's condition. Extensive baseline data from the initial evaluation will be used in assessing changes in ocular status over time. Each follow-up examination will result in a new recommendation regarding fitness for continued flying duty. Work on this unit was formerly conducted under 7755-09-04.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0030, EFFECTS OF INSPIRED GASES ON THE METABOLISM OF PULMONARY SURFACTANT
R.J. KING, Univ. of Texas, School of Medicine, *San Antonio, Texas* 78284 (DF048660; AF-AFOSR-3323-77)

AF function - Air Force operating environments expose personnel to a wide variety of environmental stresses and potential hazards which can limit or degrade man's ability to perform effectively. These stresses include extremes of pressure and pressure changes, breathing gases and temperature extremes. These stressors are frequently experienced in combination with each other and with other factors such as high human operator work loads and mechanical forces. Deficiency - the use of elevated concentrations of oxygen is probably the most important single factor in the development of atalectasis in pilots of high-performance aircraft. Aviators breathing pure oxygen at reduced pressures are particularly susceptible to absorptional atalectasis and often experience this condition during a breath-hold or when airway obstruction occurs during exposure to acceleration. Objective - the overall objective is to provide information as to whether breathing oxygen at concentrations and durations employed by USAF crewmembers will affect the metabolism or function of pulmonary surface active material. How research contributes - this work will directly support subarea 1.5, 'habitable crew environments in AF operations'. It closely supports exploratory development work conducted under TPO 6, USAFSAM/VN.

Methods will be developed for isolating pulmonary surface active material, analyzing its constituents and identifying any unique components. Additionally, new techniques will be devised for quantifying surface active materials, purifying enriched populations of alveolar epithelial cells and conducting metabolic studies on these cells of normal and 100 percent oxygen-exposed animals.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0031, ADVANCED INSTRUCTOR OPERATOR STATION DISPLAY EVALUATION TECHNIQUES
C. ELWORTH, Boeing Company, *Seattle, Washington* 98108 (DF228130; F33615-77-C-0017)

Develop techniques for scientifically measuring and quantifying display effectiveness as it relates to the performance monitoring task of an instructor pilot during aircraft simulator operation. Recent and current AF specifications require or permit the use of CRT displays for providing performance-relevant information to the instructor pilot. When a CRT is used, there are a great number of ways by which flight and performance data may be illustrated. Justification for choosing or developing one method over another is seldom if ever provided in terms of hard data due to the virtual non-existence of such data. This work will develop techniques for providing this data.

The contractor will review instructor pilot duties at the IOS and devise tasks which are sensitive to display techniques and formatting. Contractor will also devise measures to be applied to this task which can be used to quantify the effectiveness of various alternate displays used in conjunction with this task.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, NUMERICAL TECHNIQUES FOR OPTIMIZATION AND SYSTEMS OF NONLINEAR EQUATIONS

P.S. JENSEN, Lockheed Missiles & Space Co., *Palo Alto, California* 94304 (DF044770; F49620-76-C-0003)

AF function - design of aerospace vehicles. Deficiency - no effective analytical and computational methods are available for optimizing the complex structures used in the bodies and parts of aerospace vehicles. Objective - to develop, implement and test efficient algorithms for global optimization and the solution of nonlinear systems of equations. How work contributes - computer codes for use in the design of structures will be developed under this effort.

Algorithms for optimization and the solution of systems of nonlinear equations will be developed, implemented as computer programs, tested and documented. The emphasis of the effort on optimization will be on algorithms for achieving global rather than local optima. The emphasis of the effort on the solution of nonlinear systems will be on algorithms appropriate for use in the integration of stiff oscillatory problems. Methods suitable for broad application will be sought rather than methods that exploit specific problem characteristics, subject to the above emphases.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0002, STRUCTURE OF MATERIALS, ELECTROMAGNETIC SCATTERING AND FLUID DYNAMICS

R.P. GILBERT, Univ. of Delaware, School of Arts & Sciences, *Newark, Delaware* 19711 (DF041300; AF-AFOSR-2879-76)

AF function - design of aerospace vehicles. Deficiency - more critical design criteria require more exact evaluation involving additional physical effects. Objective - increased understanding of the equations of fuel tank oscillations, aircraft panel flutter, structural stability and vibration, etc. How work contributes - improved analysis of these less familiar models may suggest methods of control.

The above problems involve boundary value problems for relatively unfamiliar higher order partial differential equation. Fundamental solutions, generated by more familiar lower order techniques when the equation is cast in a certain matrix form, can be used to obtain boundary integral equations. Study of the fundamental solutions of linear problems not only suggests possibly useful physical properties but is also important to the solution of the boundary integral equations even when certain nonlinearities occur and invariant imbedding techniques must be used. Selected prototype problems will be addressed by these techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0003, COMPUTER SOLUTION OF NONLINEAR ALGEBRAIC EQUATIONS

K.M. BROWN, Univ. of Minnesota, School of Engineering, *Minneapolis, Minnesota* 55414 (DN475372; N00014-76-C-0329)

This work will provide improved computer procedures (algorithms) for the solution of nonlinear algebraic equations and for (unconstrained) optimization. Nonlinear equations must be solved in order to describe many nonlinear physical phenomena which occur in design considerations for Navy vehicles. Such equations must also be solved in the process of computer design trade-offs for almost all electromechanical systems, e.g., control systems for aircraft and missiles. In almost all cases, the present knowledge of algorithms for the solution of nonlinear equations is inadequate for the engineering applications at hand. Unconstrained optimization, particularly in the form of nonlinear least squares problems, is pervasive in science and engineering.

The principal investigator has designed 'local' algorithms which are quite effective. That is, these algorithms solve nonlinear equations and optimization problems if provided with a sufficiently good initial guess at the solution. The investigator will improve these algorithms so that, in a precise sense, they take the least possible computer time for a given problem. He will also implement heuristic procedures for automatically providing good initial guesses. Portable FORTRAN computer programs, which can be immediately used by Navy laboratories, will be produced.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

7.0004, NUMERICAL SOLUTIONS OF THE NAVIER STOKES EQUATIONS FOR COMPLEX CONFIGURATIONS

G. MORETTI, Polytechnic Inst. of New York, School of Engineering, *Farmingdale, New York* 11735 (DN524858; N00014-75-C-0511)

An accurate and detailed knowledge of the flow fields about naval aircraft and missiles is essential for the design of new and advanced systems. This theoretical investigation will develop and exploit new numerical procedures for solving the equations of motion to describe aerodynamic flows for all speed ranges with emphasis on transonic and supersonic speeds.

Numerical techniques for the solution of the equations of motion for continuum flow will be developed with particular emphasis on practical accuracy, resolution of detail in the flow field, and the efficiency of computing. Attention will be devoted to the calculation of combined viscous-inviscid flow fields about complex bodies at high Reynolds numbers. The approach will utilize the Euler equations and the boundary layer equations in a unified fashion so that both flows will be calculated in a single frame of reference. Initially two-dimensional and axially symmetric flows will be considered to develop procedures which can then be applied to an elliptic cross-section delta wing. Flows with and without separation will be treated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

7.0005, THE APPLICATION OF DIFFUSION APPROXIMATIONS TO THE STUDY OF TIME-SHARING COMPUTER SYSTEMS AND TRANSITORY QUEUEING SYSTEMS

J.P. LEHOCZKY, Carnegie Mellon University, School of Hum. & Soc. Sci., *Pittsburgh, Pennsylvania* 15213 (DF038000; AF-AFOSR-2642-74)

AF function - particular stochastic models of Air Force interest will be investigated using diffusion approximation. These include models of time-sharing computer systems, communication queueing systems, maintenance-repair systems, aircraft maintenance scheduling, and life testing for components and systems reliability. Deficiency - in modeling for the maintenance-repair systems with existing methods the system would be of such high dimensionality that any analysis would be intractable. In queueing systems it is very difficult to calculate the distribution of the maximum queue length, the virtual waiting time during a busy period and the length of the busy period. Objective -model the above systems in a way that allows for their more efficient analysis. How work contributes - the proposed research should allow for more accurate models and efficient and easier techniques of analysis for the above systems.

Find a method of reducing the high dimensionality involved in the modeling and analysis of the maintenance-repair systems. To develop methodology that allows for the relatively simple calculation of system parameters. To assess the goodness of the methods developed and determine guidelines for their use. Continue the study of diffusion approximations and several related problem areas. The technique of processor sharing will be utilized to overcome the high dimensionality encountered in modeling the maintenance-repair systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0006, CONTACT AND FRACTURE PROBLEMS IN POWER LAW VISCOELASTIC MATERIALS
A. NACHMAN, Texas A & M University System, School of Science, *College Station, Texas* 77843 (DF048270; AF-AFOSR-3290-77)

AF function - engineering intuition relating to tire impact on a runway, composite bonding, etc. Deficiency - mathematical techniques and solutions for power law viscoelastic materials. Objective -solution of two-dimensional, time-dependent contact and fracture problems. How work contributes - by suggestive examples, exhibiting and quantifying relevant non-intuitive effects.

The motion of a crack tip in a power law viscoelastic layer important to bonding, Shallamach waves of detachment for a sliding tire over pavement, etc., will be investigated by reduction to a coupled system of dual relation problems or integral equations. Mathematical techniques used include Fourier and Mellin transforms, Abel integral equation solutions, and other techniques used on Cauchy integral equations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0007, MATHEMATICAL SIMULATION OF THE CARDIOPULMONARY SYSTEM
R.E. COLLINS, Univ. of Houston, School of Arts & Sciences, *Houston, Texas* 77004 (DF041800; AF-AFOSR-2905-76)

AF function - aircrew members operating high-performance aircraft such as the F-15 and F-16 are exposed to increasing levels of rapid-onset, long-duration, repetitive g-stresses. Data from USAFSAM and other facilities indicate that the effects on the cardiopulmonary system may be the limiting factor in pilots' performance in air combat. Deficiency - a good physiological model of the cardiopulmonary system under g-stress is needed to provide human performance modelers the means to optimize combat tactics. Objective - the objective of this effort is to develop a mathematical model of the cardiopulmonary system. How work contributes - the research directly addresses basic problems associated with stress from aerial maneuvers and supports RO 1.6, mechanical forces.

Initially a mathematical model capable of simulating pulmonary mechanics and ventilation in normal and high-g environments is to be developed, in the second stage diffusion and perfusion will be incorporated and finally mechanisms of feedback and control will be added.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, RELIABILITY PHYSICS STUDIES ON DOPED ALUMINUM CONDUCTOR FILMS
J. BLACK, Motorola Incorporated, *Phoenix, Arizona* 85008 (DF735920; F30602-76-C-0300)

To provide funds for the study of doped aluminum conductor films in terms of their chemical and structural influence on integrated circuit reliability.

Appropriate test structures and IC's will be built with aluminum thin-film conductors doped with silicon or copper. Accelerated stress tests will be used to determine the chemical stability of these films, their resistance to electro-migration, their interaction with other device features such as deposited dielectric layers and silicon contacts. The information generated on this study will be used to enhance IC reliability through improved test methods and general device specifications. The end item will be a report.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

8.0002, EXPERIMENTAL AND THEORETICAL STUDY OF II-IV-V COMPOUNDS
C.Y. FONG, Univ. of California, School of Letters & Science, *Davis, California* 95616 (DF044950; F49620-76-C-0016)

AF function - microwave electronic devices are important elements of Air Force communications and countermeasures systems. Opportunity -improved performance can be expected from the use of new solid-state materials for the generation and detections of microwave signals. Present microwave solid-state device performance is limited by the properties associated with the structure of the device materials. Objective - the objective of this research program is to determine if the electronic band structure of these materials exhibits sufficiently interesting negative mass states to warrant further investigations of electron transport to ascertain their potential for utilization in solid state microwave amplifiers and generators. How work contributes - these compounds belong to a class of group II-VI-V2 compounds that have a number of interesting physical properties possibly including negative mass charge carriers suggesting potential technological utility, especially for microwave devices. Semiconductors have negative mass charge carriers.

This research investigates experimentally and theoretically the electronic band structure of the anisotropic semiconductors CdSiP2, CdSnP2, CdSiAs2, and CdSnAs2.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0003, ION IMPLANTATION IN GAAS SUBSTRATES
T.J. MCGEE, S R I International, *Menlo Park, California* 94025 (DF103290; F33615-75-C-1084)

AF function - communication, target identification, surveillance. Deficiency - present microwave devices have severe performance limitations at the higher microwave frequencies, and require improved reproducibility and reliability. Research - study the doping of n-type dopants into semi-insulating GaAs substrates (epitaxial or bulk) by ion implantation to obtain high-conductivity layers of high doping efficiency. Research is directed towards the understanding of the important parameters characterizing implantations such as the depth distribution and the lattice location of the implanted atoms, the amount of radiation damage and its anneal behavior, and the electrical properties of the implanted layer. How research contributes - many potential GaAs microwave devices are largely dependent upon the successful incorporation of impurity dopants. Ion implantation provides an attractive doping technique for the production of thin n-type layers on semi-insulting GaAs substrates. It should be potentially more advantageous and simpler than epitaxial growth. It is possible to achieve isolation of devices by implanting selected regions through masks without mesa-etching or other techniques. It should be possible to produce n super plus layers for making a good Ohmic contact. Specific applications of output from this research are expected to improve performance of microwave devices, solid-state opto-electronic devices, semiconductor lasers and integrated optical circuit elements.

GaAs single crystals in bulk or expitaxial form will be ion implanted with S, Se and Te ions in the energy ranges of 10 to 400 keV. Such parameters as implant temperature and dose, and anneal temperature will be varied. The electron concentration and mobility will be determined by measurement of the sheet resistance and Hall coefficient. The electron distribution will be determined by different Hall measurement and C-V measurements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

8.0004, ION PHOTOFRAGMENT SPECTROSCOPY - POTENTIAL SURFACES OF MOLECULAR IONS
J.T. MOSELEY, S R I International, *Menlo Park, California* 94025 (DF043690; F44620-76-C-0095)

AF function - Air Force operations in reconnaissance, communications, detection and discrimination require understanding of complex atomic, molecular and ionic phenomena that occur in the natural and disturbed atmosphere. Deficiency - there is a lack of sufficient, quality information on fundamental processes that occur in the atmosphere that affect electron densities, which

hinder propagation of electromagnetic signals in the presence of perturbed atmosphere backgrounds. Objective -investigate the energy and angular distributions of photofragment ions from parent molecular ions important in the atmosphere and interpret experimental results in terms of the parent ion molecular potentials and structural properties. Examine and interpret photodetachment cross sections if important in these ions. How work contributes - provides a measure of ion and electron densities in the normal and disturbed atmosphere which affect communication signals. Also important in the development of high-energy lasers.

Use of laser and a fast ion beam apparatus termed the coaxial-beam photofragment spectrometer to produce photofragmentation of polyatomic atmospheric ions and other ions of interest. Determine photofragment energy and angular distributions to establish the structural properties of the ions. If important, interpret results of photodetachment cross-section investigations in terms of vertical detachment energies and electron affinities.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0005, LASER PHYSICS - LIFETIME MEASUREMENTS, UV-LASER MEDIA, AND EXCITED-STATE SPECTROSCOPY

W.R. BENNETT, Yale University, Graduate School, *New Haven, Connecticut* 06520 (DF018850; F44620-76-C-0078)

AF function - future operation of aerospace systems requires improved devices for navigation, guidance, reconnaissance, and communications. Opportunity - laser technology is expected to provide assistance in meeting some of these objectives by providing more powerful and versatile sources, and more sophisticated methods of using optical devices. An understanding of physical mechanisms in gas laser media will lead to a description of the specific operating parameters for these laser sources and related components and their uses. Objective - this research emphasizes precision lifetime measurements, the study of excited-state transfer processes, laser media and excited-state spectroscopy in potential gas laser media. Contribution - this research will contribute to an understanding of relaxation mechanisms and the general properties of gas laser media leading to a description of the specific operating parameters for improved laser sources and related components and their uses. The results are expected to provide criteria for the design of new systems employing improved efficiencies and higher power with operation from the infrared to the ultraviolet.

Precision state lifetime measurements and line broadening studies will emphasize the importance of these parameters to the mode and stability analysis of gas laser systems. Ultimately, such studies could lead to a simple, ultra-stable laser with an extremely short cavity time constant which would impact the laser communications field. Investigations will pursue the application of line profile measurements to passively probe the boundary layer and/or cathode sheath in laser discharges to obtain information on local electric field strength, gas temperature, electron density and energy distribution. Previously developed techniques for lifetime measurements, gain measurements and line profile analyses will be applied to examine the physical processes in excimer gas laser systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0006, SURVEILLANCE - TIME-DEPENDENT SUPERCONDUCTING DEVICE CHARACTERISTICS

R.A. PETERS, Catholic University of America, School of Arts & Sciences, *Washington, District of Columbia* 20017 (DN675455; N00016-76-C-0845)

The objective is to study the role of time-dependent phenomena in determining the characteristics of superconducting devices which can be used in surveillance and communication systems of naval interest.

The signal strength and dimensional and frequency limitations of Josephson junction arrays and SQUIDS will be studied as a function of inelastic -electron-phonon collision time and quasiparticle diffusion distance. Also the extension of quasiparticle diffusion theory into the RF region will be experimentally tested. Superconducting samples will be supplied by the Naval Research Laboratory.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0007, STRUCTURAL PHASE TRANSITIONS AND HIGH-TEMPERATURE SUPERCONDUCTORS

W.L. MCMILLAN, Univ. of Illinois, School of Liberal Arts & Sci., *Urbana, Illinois* 61801 (DMR77-27091)

Theoretical studies will be made in three related areas of solid-state physics: electronically driven structural phase transitions, the general theory of phase transitions and superconductivity. Work will continue on the development of the perturbation approach to critical phenomena. Electronic models of the effect of defects on the superconducting transition and effects of phonon softening near the martensitic transition on superconductivity in A-15 compounds will be studied. Monte Carlo calculations will be applied to the anharmonic Hamiltonian of structural phase transitions. This is a continuation of work funded under DMR75-20376.

First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0008, RESONANT AND NON-RESONANT OPTICAL FREQUENCY MIXING IN SIMPLE MOLECULAR SYSTEMS

J.F. WARD, Univ. of Michigan, School of Lit. Sci. & The Arts, *Ann Arbor, Michigan* 48104 (DF034440; AF-AFOSR-3225-77)

AF function - this is an investigation in nonlinear optics concerned principally with the physical principles involved in harmonic generation. Such effects are particularly important in doubling and tripling schemes to generate new laser frequencies for Air Force applications. Opportunity - the need to have laser sources at additional wavelengths and to provide tunable sources for avionics applications increases the importance of having more fundamental knowledge of nonlinear optics. Objective - investigations directed towards a fundamental understanding of the relation of nonlinear coefficients to microscopic composition, the propagation problem, and the resonant enhancement of nonlinear processes. Contribution - the most important problem in the technological application of nonlinear optics is the improvement of optical frequency conversion efficiency. The investigations of this grant offer potential contributions to this improvement. In technology, emphasis has been placed on the use of crystalline nonlinear media, and the careful correlation of theory and experiment for simple systems will lead to insight which will extend to crystals. However, increasing recognition is being given to the advantages offered by fluids as media for optical frequency conversion.

This research involves a continuing program of investigations in nonlinear optics including: (a) a study of the second- and third-order susceptibilities of simple molecules involving measurements of the temperature dependence of DC electric field-induced second harmonic coefficients. Many of the simple molecules exist in the liquid phase at ambient temperatures but are being studied as essentially non-interacting individual molecules in a hot vapor, (2) a study of resonantly enhanced third harmonic generation, two-photon absorption and doubly resonant, four-photon parametric oscillation in cesium vapor. Emphasis will be placed on understanding saturation effects and the role played by processes such as stark shifts and multi-photon ionization, (3) use of a nitrogen laser pumped dye laser to other atoms. Initial experiments will be carried out in potassium vapor.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0009, THE STUDY OF VIBRATIONALLY EXCITED MOLECULES BY LOW-ENERGY ELECTRON SCATTERING

P.D. BURROW, Univ. of Nebraska, School of Arts & Sciences, *Lincoln, Nebraska* 68508 (ENG77-14649)

The research deals with the detection and study of vibrationally excited molecules by means of low-energy electron scattering techniques. Two methods for the determination of vibra-

tional populations will be used and applied to excited nitrogen. Other electron impact processes with excited molecules will be investigated. Cross sections for collision processes such as ionization and dissociative attachment will be studied as a function of vibration content, for example, a study of the ionization of vibrationally excited nitrogen. New diagnostic techniques to examine the vibrational distribution of molecules will be developed. The production and deactivation of vibrationally excited molecules by collision with hot metal walls will be investigated. It appears that the numbers of collisions with a hot wall which are required before the vibrational temperature of a gas in contact with the wall reaches equilibrium with the wall temperature have not yet been determined quantitatively. Research will be initiated by using diagnostic techniques in conjunction with an oven source for vibrationally excited molecules. The oven will possess a simple tubular geometry with a variable length such that the number of wall collisions can be estimated with accuracy. The optical temperature of the oven and the vibrational distribution of the effusing molecules will be monitored. The research is a continuation of that done under NSF Grant No. ENG-7102472 AO1.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

8.0010, SOLIDS BY POSITRON ANNIHILATION
W. BRANDT, New York University, School of Arts & Sciences, *New York, New York* 10012 (DMR76-81771 A01)

The experimental and theoretical studies of positrons in solids previously supported by DMR74-11678 A02 will be continued. Efforts will be directed to further development of the theoretical basis for the positron method, the measurement of the transport properties of positrons in solids, and expansion of the analysis of positronium formation processes in dipolar and photomagnetic substances, and the investigation of the interaction of positrons with solid surfaces.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0011, PARAMETER-FREE ELECTRONIC CALCULATIONS IN CRYSTALS AND THIN FILMS
I. SHAVITT, Battelle Memorial Institute, *Columbus, Ohio* 43201 (DF042470; F44620-76-C-0026)

AF function - electronic systems depend heavily upon solid-state electronic and optical devices. Improvement in current devices and development of new ones requires a thorough understanding of the electronic structure in electromagnetic materials. Opportunity - a major tool used in electronic structure and optical properties investigations is calculational techniques. Almost all such calculations have used approximation or were adjusted to correspond to experimental results. Objective - this research will develop a technique for complete ab initio calculations of electronic energy in crystals and thin films. The ultimate goal is to be able to accurately predict the electronic and optical properties of electromagnetic materials without the availability of experimental data.

The technique is based on an unrestricted-Hartree-Fock method which requires no input of experimental data other than crystal symmetry and involves no adjustable parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, GROUND-BASED INFRARED PHOTOMETRY AND MAPPING OF ENERGETIC EXTRAGALACTIC INFRARED SOURCES
G.H. RIEKE, Univ. of Arizona, Lunar & Planetary Laboratory, *Tucson, Arizona* 85721 (AST76-81874 A01)

The infrared emission of extragalactic sources will be studied through extensive ground-based observations, continuing a program that has resulted in many discoveries in this area. Detailed measurements of the infrared spectra, sizes, and variability will be obtained of the brighter sources; and surveys of fainter sources will be continued to define the general infrared properties of extragalactic objects. More limited research will be carried out in the areas of infrared polarimetry, study of interstellar molecular hydrogen, and far infrared detection techniques.

This will provide additional funding and extend the research begun under AST 76-81874.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0002, IMAGE RECONSTRUCTION USING LARGE ASTRONOMICAL TELESCOPES
P.A. STRITTMATTER, Univ. of Arizona, School of Liberal Arts, *Tucson, Arizona* 85721 (DF248810; F19628-77-C-0063)

AF function - communications, surveillance, detection, tracking. Deficiency - severe limitation in observing fine spatial details on deep space objects. Objective - to utilize new and existing techniques used in observational stellar astronomy to assist in solving Air Force needs in the areas of satellite identification and monitoring. How research contributes - enables the Air Force to increase spatial resolution through the atmosphere by a factor of over fifty.

A data acquisition system to obtain short-exposure astronomical photographs used in the technique known as 'speckle interferometry'. This system will be used to obtain test and evaluation data on both man-made space objects (satellites) and non-man-made objects (stars, asteroids and extended nebulae). These data will be used to develop and perfect data processing schemes to recover images with spatial detail approaching the best theoretically possible in the absence of atmospheric turbulence.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

10.0003, X-RAY ENVIRONMENTAL LIMITS TO MILITARY SYSTEMS HARD X-RAY AND GAMMA RAY ASTRONOMY
J.D. KURFESS, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN480107)

To monitor the hard X-ray and gamma-ray environment in the upper atmosphere and in space, including solar emission, cosmic gamma-ray bursts, intense celestial sources and the atmospheric/magnetospheric background. Solar gamma-ray emission is of interest because of the potential for an improved prediction capability for flare-related communications disturbances. Improved detection capabilities are also required for monitoring high-altitude nuclear tests and for satellite inspection.

Sensitive gamma-ray detectors are flown on stratospheric balloons and satellites to monitor the X-ray environment. Extended observations are required to meet the objectives, therefore a ballon-borne system capable of around-the-world flight durations of 100 days or longer has been developed for use with long-duration balloon systems.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

10.0004, NATURE OF SHORT-PERIOD BINARY STARS FROM AN OBSERVATIONAL VIEWPOINT
R.E. WILSON, State University of Fla. Sys., School of Natural Sciences, *Tampa, Florida* 33620 (AST77-09188)

Fundamental data will be extracted from existing light curves of contact and other short-period binary stars as a test of theories of the structure and evolution of these binaries and a stimulus to new theoretical ideas. Large numbers of such systems need analysis to permit meaningful statistical studies of their properties. The work will include W UMa-type and other contact binaries, also 'short-period Algol', and 'short-period Beta Lyrae' type systems, so far almost completely neglected except for gathering of observations. This basic ground-work should lead to a better understanding of the nature of these latter type systems from an evolutionary point of view. The light curve and differential corrections programs developed by the investigators will be further

improved, and the latest versions made available to workers in the field.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N78-27045*# ECON, Inc., Princeton, N. J.
THE BENEFITS OF IMPROVED TECHNOLOGIES IN AGRICULTURAL AVIATION
Feb. 1978 362 p refs
(Contract NASw-2781)
(NASA-CR-157051) Avail: NTIS HC A16/MF A01 CSCL 02C

The economic benefits attributable to a variety of potential technological improvements in agricultural aviation are discussed. Topics covered include: the ag-air industry, the data base used to estimate the potential benefits and a summary of the potential benefits from technological improvements; ag-air activities in the United States; foreign ag-air activities; major ag-air aircraft is use and manufacturers' sales and distribution networks; and estimates of the benefits to the United States of proposed technological improvements to the aircraft and dispersal equipment. A bibliography of references is appended. A.R.H.

N78-27046*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CTOL TRANSPORT TECHNOLOGY, 1978
Jun. 1978 516 p refs Conf. held at Hampton, Va., 28 Feb. - 3 Mar. 1978
(NASA-CP-2036-Pt-1; L-12178) Avail: NTIS HC A22/MF A01 CSCL 02A

Technology generated by NASA and specifically associated with advanced conventional takeoff and landing transport aircraft is reported. Topics covered include: aircraft propulsion; structures and materials; and laminar flow control. For individual titles, see N78-27047 through N78-27072.

N78-27047*# National Aeronautics and Space Administration, Washington, D. C.
OVERVIEW OF NASA CTOL PROGRAM
James J. Kramer *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 1-7 (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 02A

Technology generated by NASA and specifically oriented toward advanced commercial air transport is reviewed. Results of the Aircraft Energy Efficiency program and of related disciplinary areas are reported. The CTOL research efforts are put into perspective relative to the total NASA aeronautics program. J.M.S.

N78-27048*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ACEE PROPULSION OVERVIEW **c07**
Donald L. Nored *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 9-23 refs (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 21E

Technology for fuel-efficient subsonic CTOL transport aircraft is discussed. The engine component improvement project, the energy efficient engine project, and the advanced turboprop project are included. The overall goals and objectives of each project are reviewed and the approach and schedule for accomplishing these project goals and objectives are given. J.M.S.

N78-27049*# General Electric Co., Fairfield, Conn.
CF6 JET ENGINE PERFORMANCE DETERIORATION RESULTS **c07**
R. J. Lewis, C. E. Humerickhouse, and J. E. Paas *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 25-44 refs (For primary document see N78-27046 18-01)
(Contract NAS3-20631)
Avail: NTIS HC A22/MF A01 CSCL 21E

The use of the performance baseline from the flight planning manual as a reference to measure changes in cruise fuel flow rates was discussed. For the CF6-6D engine, the introduction of design changes for performance and durability reasons was seen to introduce an average increment relative to this baseline of 3.2% WFM increase at NI, 2.5% Fn increase at NI, 0.8% specific fuel consumption (SFC) increase at Fn, and 7 C EGT increase at NI, while maintaining sufficient SFC margin of the delivered airplane. The effect of revenue service deterioration and performance restoration relative to the reference was shown to be an adder on top of these design effects. A schematic of typical CF6-6D performance through revenue service and airline maintenance is presented in terms of percent cruise SFC relative to an airline datum point (average level upon entering revenue service). The typical changes in SFC margin are shown for airline revenue service through for installations and refurbishments. J.M.S.

N78-27050*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
JT9D JET ENGINE PERFORMANCE DETERIORATION **c07**
A. Jay, E. S. Todd, and G. P. Sallee *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 45-58 (For primary document see N78-27046 18-01)
(Contract NAS3-20632)
Avail: NTIS HC A22/MF A01 CSCL 21E

The analytical techniques utilized to examine the effects of flight loads and engine operating conditions on performance deterioration are presented. The role of gyroscopic, gravitational, and aerodynamic loads are shown along with the effect of variations in engine build clearances. These analytical results are compared to engine test data along with the correlation between analytically predicted and measured clearances and rub patterns. Conclusions are drawn and important issues are discussed. J.M.S.

N78-27051*# General Electric Co., Fairfield, Conn. Aircraft Engine Group.
CF6 PERFORMANCE IMPROVEMENT **c07**
Dean J. Lennard *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 59-78 (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 21E

Potential CF6 engine performance improvements directed at

reduced fuel consumption were identified and screened relative to airline acceptability and are reviewed. The screening process developed to provide evaluations of fuel savings and economic factors including return on investment and direct operating cost is described. In addition, assessments of development risk and production potential are made. Several promising concepts selected for full-scale development based on a ranking involving these factors are discussed. J.M.S.

N78-27052*# Pratt and Whitney Aircraft Group, East Hartford, Conn.

ENGINE COMPONENT IMPROVEMENT: JT8D AND JT9D PERFORMANCE IMPROVEMENTS **c07**

W. O. Gaffin *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 79-80 ref (For primary document see N78-27046 18-01)

Avail: NTIS HC A22/MF A01 CSCL 21E

A feasibility analysis screening method for predicting the airline acceptance of a proposed engine performance improvement modification was developed. Technical information derived from available test data and analytical models is used along with conceptual/preliminary designs to establish the predicted performance improvement, weight and installation characteristics, the cost for new production and retrofit, maintenance cost and qualitative characteristics of the performance improvement concepts being evaluated. These results are used to arrive at the payback period, which is the time required for an airline to recover the investment cost of concept implementation, and to predict the amount of fuel saved by a performance improvement concept. The assumptions used to calculate the payback period and fuel saved are discussed. A summary of the results when the screening method is applied is presented for several representative JT8D and JT9D performance improvement concepts. An example of the input information used to develop the summary results is shown. J.M.S.

N78-27053*# Pratt and Whitney Aircraft Group, East Hartford, Conn.

ENERGY EFFICIENT ENGINE: PRELIMINARY DESIGN AND INTEGRATION STUDIES **c07**

David E. Gray *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 89-110 (For primary document see N78-27046 18-01)

Avail: NTIS HC A22/MF A01 CSCL 21E

A mixed exhaust, direct drive fan turbofan configuration was selected from four candidates. This choice was based on its ability to exceed study goals of 12% lower thrust specific fuel consumption and 5% lower direct operating cost by the 1990's with commercially acceptable technical risk and relative mechanical simplicity. The evaluation leading to configuration selection is discussed. Necessary technology advancements are identified and related to the goals. J.M.S.

N78-27054*# General Electric Co., Fairfield, Conn.

ENERGY EFFICIENT ENGINE PRELIMINARY DESIGN AND INTEGRATION STUDIES **c07**

R. P. Johnston and M. C. Hemsworth *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 111-138 refs (For primary document see N78-27046 18-01)

Avail: NTIS HC A22/MF A01 CSCL 21E

The characteristics and systems benefits of an energy efficient engine (E3) suitable for use on advanced subsonic transport aircraft were determined. Relative to a current CF6-50C engine, the following benefits were estimated: 14.4% reduction in installed cruise specific fuel consumption, and a reduction in direct operating cost of more than 5%. The advanced technology E3 system would also permit: compliance with FAR 36 (1977) noise limits, and compliance with 1981 EPA emission standards. J.M.S.

N78-27055*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

STATUS OF ADVANCED TURBOPROP TECHNOLOGY **c07**

J. F. Dugan, B. A. Miller, and D. A. Sagerser *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 139-166 refs (For primary document see N78-27046 18-01)

Avail: NTIS HC A22/MF A01 CSCL 21E

Research is reviewed in the following areas: turboprop powered transport aircraft; wind tunnel aerodynamic and acoustics tests of model propellers; turboprop maintenance; and wind tunnel tests on airframe-turboprop interactions. Continued development of the technology for advanced turboprop transport was emphasized. J.M.S.

N78-27056*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PROPULSION SYSTEMS NOISE TECHNOLOGY **c07**

C. E. Feiler *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 167-185 refs (For primary document see N78-27046 18-01)

Avail: NTIS HC A22/MF A01 CSCL 21E

Turbofan engine noise research relevant to conventional aircraft is discussed. In the area of fan noise, static to flight noise differences were discussed and data were presented for two different ways of simulating flight behavior. Experimental results from a swept rotor fan design are presented which show that this concept has potential for reducing the multiple-pure-tone or buzz-saw noise related to the shock waves on a fan operating at supersonic tip speeds. Acoustic suppressor research objectives centered around the effect of the wave system generated by the fan stage that is the input to the treatment. A simplifying and unifying parameter, mode cutoff ratio was described. Results are presented which show that suppressor performance can be improved if the input wave is more precisely described. In jet noise, calculated results showing the potential noise reduction from the use of internal mixer nozzles rather than separate flow nozzles are presented. J.M.S.

N78-27057*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ADVANCED MATERIALS RESEARCH FOR LONG-HAUL AIRCRAFT TURBINE ENGINES **c07**

R. A. Signorelli and C. P. Blankenship *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 187-204 refs (For primary document see N78-27046 18-01)

Avail: NTIS HC A22/MF A01 CSCL 21E

The status of research efforts to apply low to intermediate temperature composite materials and advanced high temperature materials to engine components is reviewed. Emerging materials technologies and their potential benefits to aircraft gas turbines were emphasized. The problems were identified, and the general state of the technology for near term use was assessed. J.M.S.

N78-27058*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

GAS TURBINE ENGINE EMISSION REDUCTION TECHNOLOGY PROGRAM **c07**

Donald A. Petrash and Larry A. Diehl *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 205-216 (For primary document see N78-27046 18-01)

Avail: NTIS HC A22/MF A01 CSCL 21E

Progress in the development of combustor technology to meet the standards for the allowable pollutant emission levels of aircraft gas turbine engines is reported. The high-bypass-ratio turbofan engines which power the large commercial aircraft were emphasized along with efforts to reduce emission for near term applications. Recommendations for continuing research to reduce emissions to meet far term needs are given. J.M.S.

N78-27059*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

IMPACT OF BROAD-SPECIFICATION FUELS ON FUTURE JET AIRCRAFT **c28**

Jack Grobman *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 217-233 refs (For primary document see N78-27046 18-01)

Avail: NTIS HC A22/MF A01 CSCL 21D

The effects that broad specification fuels have on airframe and engine components were discussed along with the improvements in component technology required to use broad specification fuels without sacrificing performance, reliability, maintainability, or safety. J.M.S.

N78-27060*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

INTRODUCTION TO SESSION ON MATERIALS AND STRUCTURES **c24**
Louis F. Vosteen *In its* CTOL Transport Technol., 1978 Jun. 1978 p 235-237 (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 11D

A review was given of the development of composites for aircraft. Supporting base technology and the Aircraft Energy Efficiency Composites Program are included. Specific topics discussed include: (1) environmental effects on materials; (2) material quality and chemical characterization; (3) design and analysis methods; (4) structural durability; (5) impact sensitivity; (6) carbon fiber electrical effects; and (7) composite components. J.M.S.

N78-27061*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ENVIRONMENTAL EFFECTS ON COMPOSITES FOR AIRCRAFT **c24**
Richard A. Pride *In its* CTOL Transport Technol., 1978 Jun. 1978 p 239-258 refs (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 11D

The influence of the operational environment on the behavior of composite materials and aircraft components fabricated with these composite materials was considered. Structural weight savings, manufacturing cost savings, and long-term environmental durability are among the factors examined. The flight service experience to date of composite components is evaluated. In addition, the influence of a number of worldwide, ground based outdoor exposures on the physical and mechanical properties of six composite materials is discussed. In particular, the current extent of the ultraviolet surface degradation and the moisture gained by diffusion is shown. J.M.S.

N78-27062*# Lockheed-California Co., Burbank.
DEVELOPMENT OF ADVANCED COMPOSITE STRUCTURES **c24**
Warren A. Stauffer and Arthur M. James *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 259-279 (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 11D

Composite structure programs: the L-1011 Advanced Composite Vertical Fin (ACVF), the L-1011 Advanced Composite Aileron, and a wing study program were reviewed. These programs were structured to provide the technology and confidence for the use of advanced composite materials for primary and secondary structures of future transport aircraft. The current status of the programs is discussed. The results of coupon tests for both material systems are presented as well as the ACVF environmental (moisture and temperature) requirements. The effect of moisture and temperature on the mechanical properties of advanced composite materials is shown. The requirements set forth in the FAA Certification Guidelines for Civil Composite Aircraft Structures are discussed as they relate to the ACVF. J.M.S.

N78-27063*# Douglas Aircraft Co., Inc., Santa Monica, Calif.
KEY ISSUES IN APPLICATION OF COMPOSITES TO TRANSPORT AIRCRAFT **c05**
M. Stone *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 281-310 refs (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 01C

The application of composite materials to transport aircraft was identified and reviewed including the major contributing disciplines of design, manufacturing, and processing. Factors considered include: crashworthiness considerations (structural integrity, postcrash fires, and structural fusing), electrical/avionics subsystems integration, lightning, and P-static protection design; manufacturing development, evaluation, selection, and refining of tooling and curing procedures; and major joint design considerations. Development of the DC-10 rudder, DC-10 vertical stablizer, and the DC-9 wing study project was reviewed. The Federal Aviation Administration interface and the effect on component design of compliance with Federal Aviation Regulation 25 Composite Guidelines are discussed. J.M.S.

N78-27064*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ADVANCED STRUCTURAL SIZING METHODOLOGY **c05**
W. Jefferson Stroud and Jaroslaw Sobieszczanski-Sobieski *In its* CTOL Transport Technol., 1978 Jun. 1978 p 311-330 refs (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 01C

Research in computerized structural sizing technology was reviewed. Areas covered include: overall design; structural subassembly design; thermal structures; and stiffened panels. In each case, sample results are presented. J.M.S.

N78-27065*# Boeing Commercial Airplane Co., Seattle, Wash.
TRANSITION FROM GLASS TO GRAPHITE IN MANUFACTURE OF COMPOSITE AIRCRAFT STRUCTURE **c05**
Harvey E. Buffum and Vere S. Thompson *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 331-347 (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 01C

The transition from fiberglass reinforced plastic composites to graphite reinforced plastic composites is described. Structural fiberglass design and manufacturing background are summarized. How this experience provides a technology base for moving into graphite composite secondary structure and then to composite primary structure is considered. The technical requirements that must be fulfilled in the transition from glass to graphite composite structure are also included. J.M.S.

N78-27066*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LAMINAR FLOW CONTROL OVERVIEW **c02**
Ralph J. Muraca *In its* CTOL Transport Technol., 1978 Jun. 1978 p 349-356 (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 01A

Application of laminar flow control technology to future CTOL long range transport aircraft was considered. Topics covered include: (1) airfoil development and test; (2) development and improvement of design methods; (3) evaluation of leading edge contamination; and (4) laminar flow control system definition and concept evaluation. J.M.S.

N78-27067*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLIGHT INVESTIGATION OF INSECT CONTAMINATION AND ITS ALLEVIATION **c05**
John B. Peterson, Jr. and David F. Fisher *In its* CTOL Transport Technol., 1978 Jun. 1978 p 357-373 refs (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 01C

An investigation of leading edge contamination by insects was conducted with a JetStar airplane instrumented to detect transition on the outboard leading edge flap and equipped with a system to spray the leading edge in flight. The results of airline type flights with the JetStar indicated that insects can contaminate the leading edge during takeoff and climbout. The results also showed that the insects collected on the leading edges at 180 knots did not erode at cruise conditions for a laminar flow control airplane and caused premature transition of the laminar boundary layer. None of the superslick and hydrophobic surfaces tested showed any significant advantages in alleviating the insect contamination problem. While there may be other solutions to the insect contamination problem, the results of these tests with a spray system showed that a continuous water spray while encountering the insects is effective in preventing insect contamination of the leading edges. J.M.S.

N78-27068*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEVELOPMENT OF ADVANCED STABILITY THEORY SUCTION PREDICTION TECHNIQUES FOR LAMINAR FLOW CONTROL **c02**
Andrew J. Srokowski *In its* CTOL Transport Technol. 1978 Jun. 1978 p 375-394 refs (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 01A

The problem of obtaining accurate estimates of suction requirements on swept laminar flow control wings was discussed. A fast accurate computer code developed to predict suction requirements by integrating disturbance amplification rates was described. Assumptions and approximations used in the present

computer code are examined in light of flow conditions on the swept wing which may limit their validity. J.M.S.

N78-27069*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESIGN OF A LAMINAR-FLOW-CONTROL SUPERCRITICAL AIRFOIL FOR A SWEPT WING c05
Dennis O. Allison and John R. Dagenhart *In its* CTOL Transport Technol., 1978 Jun. 1978 p 395-408 refs (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 01C

An airfoil was analytically designed and analyzed for a combination of supercritical flow and laminar flow control (LFC) by boundary layer suction. A shockless inverse method was used to design an airfoil and an analysis method was used in lower surface redesign work. The laminar flow pressure distributions were computed without a boundary layer under the assumption that the laminar boundary layer would be kept thin by suction. Inviscid calculations showed that this 13.5 percent thick airfoil has shockless flows for conditions at and below the design normal Mach number of 0.73 and the design section lift coefficient of 0.60, and that the maximum local normal Mach number is 1.12 at the design point. The laminar boundary layer instabilities can be controlled with suction but the undercut leading edge of the airfoil provides a low velocity, constant pressure coefficients region which is conducive to laminar flow without suction. The airfoil was designed to be capable of lift recovery with no suction by the deflection of a small trailing edge flap. J.M.S.

N78-27070*# Boeing Commercial Airplane Co., Seattle, Wash.
APPLICATION OF LAMINAR FLOW CONTROL TECHNOLOGY TO LONG-RANGE TRANSPORT DESIGN c05
L. B. Gratzer and D. George-Falvy *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 409-447 refs (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 01C

The impact of laminar flow control (LFC) technology on aircraft structural design concepts and systems was discussed and the corresponding benefits were shown in terms of performance and fuel economy. Specific topics discussed include: (1) recent advances in laminar boundary layer development and stability analysis techniques in terms of suction requirements and wing suction surface design; (2) validation of theory and realistic simulation of disturbances and off-design conditions by wind tunnel testing; (3) compatibility of aerodynamic design of airfoils and wings with LFC requirements; (4) structural alternatives involving advanced alloys or composites in combinations made possible by advanced materials processing and manufacturing techniques; (5) addition of suction compressor and drive units and their location on the aircraft; and (6) problems associated with operation of LFC aircraft, including accumulation of insects at low altitudes and environmental considerations. J.M.S.

N78-27071*# Lockheed-Georgia Co., Marietta.
TOWARD A LAMINAR-FLOW-CONTROL TRANSPORT c05
R. F. Sturgeon *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 449-495 refs (For primary document see N78-27046 18-01)
(Contract NAS1-14631)
Avail: NTIS HC A22/MF A01 CSCL 01C

Analyses were conducted to define a practical design for an advanced technology laminar flow control (LRC) transport for initial passenger operation in the early 1990's. Mission requirements, appropriate design criteria, and level of technology for the study aircraft were defined. The characteristics of the selected configuration were established, aircraft and LFC subsystems compatible with the mission requirements were defined, and the aircraft was evaluated in terms of fuel efficiency. A wing design integrating the LFC ducting and metering system into advanced composite wing structure was developed, manufacturing procedures for the surface panel design were established, and environmental and structural testing of surface panel components were conducted. Test results revealed a requirement for relatively minor changes in the manufacturing procedures employed, but have shown the general compatibility of both the selected design and the use of composite materials with the requirements of LFC wing surface panels. J.M.S.

N78-27072*# Douglas Aircraft Co., Inc., Santa Monica, Calif.
APPLICATION OF POROUS MATERIALS FOR LAMINAR FLOW CONTROL c05
Wilfred E. Pearce *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 497-522 refs (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 01C

Fairly smooth porous materials were elected for study Doweave; Fibermetal; Dynapore; and perforated titanium sheet. Factors examined include: surface smoothness; suction characteristics; porosity; surface impact resistance; and strain compatibility. A laminar flow control suction glove arrangement was identified with material combinations compatible with thermal expansion and structural strain. J.M.S.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N78-27073 Tennessee Univ., Knoxville.
STUDIES OF VARIOUS ROCKET FIN-BODY CONFIGURATIONS WITH ANGLE OF ATTACK IN LINEARIZED SUBSONIC, TRANSONIC AND SUPERSONIC FLOW Ph.D. Thesis
Nobuyoshi Uchiyama 1977 243 p
Avail: Univ. Microfilms Order No. 7807731

The methods for predicting the aerodynamic characteristics on various fin-body combinations at small angles of attack have been developed and examined by application of the slender-body theory and singularity methods. The methods are applicable to subsonic, transonic and supersonic flows within the linearized flow assumption. The configurations studied include detailed surface pressure distributions on cruciform, slender and non-slender fins which have cant angle and flap deflections. The singularity method developed for subsonic flow has been extended to include the case of moderately high angles of attack up to 20 degrees. Fin tip vortex formation and its influence on the fin-body combination surface pressure distribution was also calculated. Some results are obtained for the flow field as influenced by the fin-body interaction at these higher angles of attack. Dissert. Abstr.

N78-27074 Texas Univ. at Austin.
FLIGHT MEASUREMENTS OF THE WING TIP VORTEX Ph.D. Thesis
Nikola Soskic 1977 139 p
Avail: Univ. Microfilms Order No. 7807388

Velocity measurements were made in the wing tip vortex generated by a DHC-2 (rectangular wing, span 48 ft, chord 62.4 inches). Data were taken under very stable atmospheric conditions at three downstream locations. The vortex Reynolds number was practically the same for all tests. Three three-dimensional hot film probes were used for the velocity measurements. Tangential velocity data were fitted by the Lamb vortex equation based on a constant eddy viscosity. Extremely high maximum tangential velocities, as high as 54-72% of the free stream velocity, were found. Dissert. Abstr.

N78-27075 Kansas Univ., Lawrence.
A THERORETICAL INVESTIGATION OF THE AERODYNAMICS OF LOW ASPECT-RATIO WINGS WITH PARTIAL LEADING-EDGE SEPARATION Ph.D. Thesis
Sudhir Chandra Mehrotra 1977 88 p
Avail: Univ. Microfilms Order No. 7809419

A numerical method is developed to predict distributed and total aerodynamic characteristics for low aspect-ratio wings with partial leading-edge separation. The flow was assumed to be steady and inviscid. The wing boundary condition was formulated by the quasi-vortex-lattice method. The leading-edge separated vortices were represented by discrete free vortex elements which are aligned with the local velocity vector at mid-points. The wake behind the trailing-edge was also force free. The flow

tangency boundary condition was satisfied on the wing, including the leading- and trailing-edges. Comparison of the predicted results with complete leading-edge separation second good agreements. For cases with partial leading-edge separation the lift is found to be highly nonlinear with angle of attack. Dissert. Abstr.

N78-27076 George Washington Univ., Washington, D. C.
SOLUTIONS TO THE NAVIER-STOKES EQUATIONS FOR SUPERSONIC FLOW OVER BLUNT BODIES WITH MASSIVE WALL BLOWING Ph.D. Thesis
Randolph Anderson Graves, Jr. 1977 156 p
Avail: Univ. Microfilms Order No. 7808204

Time-dependent conservation equations which describe the laminar viscous shock layer flow of a perfect gas over an axisymmetric blunt analytic body at zero angle of attack were used to investigate the effects of massive wall blowing from a rapidly decomposing ablative heat shield during very high speed entry into the atmospheres of the giant outer planets. The governing equations are transformed so that the computational domain is rectangular, and standard finite-difference relations are used to approximate the derivatives in the governing equations. A fast numerical solution technique is developed which allows for solutions to be obtained in a few hundred time steps as compared to several thousand for standard techniques. This numerical method uses partial implicitization to solve the energy and tangential momentum equations while the continuity and normal momentum equations are solved using an integral formulation. Dissert. Abstr.

N78-27077 Stanford Univ., Calif.
EFFECT OF CHORDWISE FORCES AND DEFORMATIONS AND DEFORMATION DUE TO STEADY LIFT ON WING FLUTTER Ph.D. Thesis
William Newsome Boyd 1978 256 p
Avail: Univ. Microfilms Order No. 7808767

The aeroelastic stability of a uniform cantilever wing was analyzed in terms of the dynamically uncoupled natural modes of vibration of the uniform cantilever. Dynamic stability in the case of incompressible strip-theory airloads was determined by the Vg method and by obtaining the complex eigenvalues of the aeroelastic modes at any flight condition. Two idealized examples based upon existing sailplanes are analyzed. Steady drag loads lower the flutter speed for larger aspect ratios but increase it for aspect ratios less than a certain value. Divergence speed is more sensitive to steady drag, and for very high aspect ratio wings it can fall below the bending-torsion flutter speed. Steady deformations due to lift always decrease the flutter speed by an amount dependent upon the aspect ratio and the fore-and-aft bending stiffness. Leading-edge suction forces increase flutter speed. Dissert. Abstr.

N78-27078 Tennessee Univ., Knoxville.
AN AERODYNAMIC COEFFICIENT PREDICTION TECHNIQUE FOR SLENDER BODIES WITH LOW ASPECT RATIO FINS AT TRANSONIC MACH NUMBERS AND ANGLES OF ATTACK TO 180 DEGREES Ph.D. Thesis
William Bertram Baker, Jr. 1976 307 p
Avail: Univ. Microfilms Order No. 7807674

A semiempirical technique was developed for the prediction of normal force and pitching moment coefficients for a slender body alone and slender body plus fin configurations. Additionally, installed fin normal force, root bending and hinge moment coefficients were calculated. The semi-empirical prediction technique is valid for slender bodies with low aspect ratio fins at Mach numbers from 0.6 to 1.3 and angles of attack from 0 to 180 degrees. The range of validity of the prediction technique for the low aspect ratio from 0.5 to 2.0; taper ratio from 0 to 1.0 and span ratio from 0.3 to 0.5. Dissert. Abstr.

N78-27079*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WIND-TUNNEL INVESTIGATION OF EFFECTS OF TRAILING-EDGE GEOMETRY ON A NASA SUPERCRITICAL AIRFOIL SECTION
Charles D. Harris Washington Sep. 1971 78 p refs
(Proj. FEDD)
(NASA-TM-X-2336; L-7814) Avail: NTIS HC A05/MF A01 CSCL 01A

Wind-tunnel tests have been conducted at Mach numbers from 0.60 to 0.81 to determine the effects of trailing-edge geometry on the aerodynamic characteristics of a NASA supercritical airfoil shape. Variations in trailing-edge thicknesses from 0 to 1.5 percent of the chord and a cavity in the trailing edge were investigated with airfoils with maximum thicknesses of 10 and 11 percent of the chord. Author

N78-27080*# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Mathematics.
FINITE ELEMENT ANALYSIS OF PERIODIC TRANSONIC FLOW PROBLEMS Final Report
George J. Fix Jul. 1978 6 p refs
(Grant NsG-1367)
(NASA-CR-157261) Avail: NTIS HC A02/MF A01 CSCL 01A

Flow about an oscillating thin airfoil in a transonic stream was considered. It was assumed that the flow field can be decomposed into a mean flow plus a periodic perturbation. On the surface of the airfoil the usual Neumman conditions are imposed. Two computer programs were written, both using linear basis functions over triangles for the finite element space. The first program uses a banded Gaussian elimination solver to solve the matrix problem, while the second uses an iterative technique, namely SOR. The only results obtained are for an oscillating flat plate. B.B.

N78-27081*# National Aeronautics and Space Administration, Washington, D. C.
A FINITE VOLUME METHOD FOR CALCULATING TRANSONIC POTENTIAL FLOW AROUND WINGS FROM THE PRESSURE MINIMUM INTEGRAL
Albrecht Eberle Jul. 1978 68 p refs Transl. into ENGLISH of "Eine Methode der Finiten Volumen zur Berechnung der Transsonischen Potentialstromung um Flugel aus dem Druckminimumintegral", report no. MBB-UFE1407(0) Messerschmitt-Bolkow-Blohm GmbB, West Germany, 27 Feb. 1978 p 1-70 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-2790)
(NASA-TM-75324) Avail: NTIS HC A04/MF A01 CSCL 01A

Analysis of the pressure minimum integral in the calculation of three-dimensional potential flow around wings makes it possible to use non-rectangular mesh networks for distributing the three-dimensional potential into discrete points. The method is comparatively easily expanded to the treatment of realistic airplane configurations. Shock-pressure affected pressure distributions on any wings are determined with accuracy using this method. G.G.

N78-27082*# National Aeronautics and Space Administration, Washington, D. C.
EXPERIMENTAL STUDIES ON THE INFLUENCE OF THE DEGREE OF TURBULENCE AND OF A TURBULENCE THREAD ON THE COMPRESSIBLE SUBSONIC FLOW THROUGH FLAT COMPRESSOR CASCADES
K. Barsun Jul. 1978 72 p refs Transl. into ENGLISH of German report DFL-0509, Rept-68/34, 1968 p 1-68 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany)
(Contract NASw-2790)
(NASA-TM-75276) Avail: NTIS HC A04/MF A01 CSCL 01A

The measurements revealed that at low Reynolds numbers the profile loss is considerably reduced both by the increased degree of turbulence and by a turbulence thread, while it is somewhat increased at high Reynolds numbers, and that a profile loss reduction is connected with an increase in deflection and in pressure shift. The turbulence generator is most effective on the one hand in the middle of the operating range of the cascades, and on the other at very high Mach numbers together with a large angle of incidence. L.S.

N78-27083*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTER PROGRAMS FOR CALCULATING TWO-DIMENSIONAL POTENTIAL FLOW IN AND ABOUT PROPULSION SYSTEM INLETS
J. Dennis Hawk, Norbert O. Stockman, and Charles A. Farrell, Jr. Jun. 1978 366 p refs

(NASA-TM-78930; E-0671) Avail: NTIS HC A16/MF A01 CSCL 01A

Incompressible potential flow calculations are presented that were corrected for compressibility in two-dimensional inlets at arbitrary operating conditions. Included are a statement of the problem to be solved, a description of each of the computer programs, and sufficient documentation, including a test case, to enable a user to run the program. G.G.

N78-27084*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AERODYNAMIC CHARACTERISTICS OF A COUNTER-ROTATING, COAXIAL, HINGELESS ROTOR HELICOPTER MODEL WITH AUXILIARY PROPULSION

Arthur E. Phelps and Raymond E. Mineck May 1978 85 p refs

(NASA-TM-78705) Avail: NTIS HC A05/MF A01 CSCL 01A

A wind-tunnel model test at advance ratios from 0 to 0.3 with and without auxiliary jet engine thrust is reported. At each advance ratio and engine thrust, both the control power and the aircraft stability were measured. The results indicate that there is a cross-coupling for collective pitch and longitudinal cyclic pitch inputs. The control power for these inputs increased with advance ratio. There was also cross-coupling for differential collective pitch inputs. The airframe was longitudinally unstable, but the instability was less at the highest advance ratio tested. The airframe showed both positive effective dihedral and positive directional stability. G.G.

N78-27085*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A BRIEF SURVEY OF ROTARY WING INDUCED-VELOCITY THEORY

Harry H. Heyson Jun. 1978 67 p refs Presented at seminar on Aerodyn. of V/STOL Aircraft and Helicopters, University Park, Pa., 31 Jul. - Aug. 1978

(NASA-TM-78741) Avail: NTIS HC A03/MF A01 CSCL 01A

An attempt is made to summarize the state of rotary wing flow fields. The theory is traced from its origin as a momentum theory estimate of average interference, through simple vortex theory, to its present status where it is indispensible in calculating blade loads. A comparison of the theory with flow measurements are presented. The modern efforts toward using more detailed digital methods to obtain blade load distribution are described. G.Y.

N78-27086*# National Aeronautics and Space Administration, Washington, D. C.

STUDIES IN EXPERIMENTAL AERODYNAMICS

S. M. Gorlin, ed. Aug. 1978 92 p refs Transl. into ENGLISH from Nauch. Tr. Mosk. Gos. Univ. (Moscow), no. 4, 1970 p 1-81 Sponsored by Franklin Book Programs, Inc., Cairo

(Contract NSF C-724)

(NASA-TT-F-17158) Avail: NTIS HC A05/MF A01 CSCL 02A

The results are presented of studies carried out on the aerodynamic characteristics and the flow-past of different bodies at subsonic velocities. The influence of the initial turbulence of flow on the aerodynamic characteristics, as well as the influence of a screen on the development of a jet flow and a flow-past were considered. The aerodynamic characteristics of cylindrical structures and rapid trains are given. D.L.G.

N78-27087*# Boeing Commercial Airplane Co., Seattle, Wash.

A MACH LINE PANEL METHOD FOR COMPUTING THE LINEARIZED SUPERSONIC FLOW OVER PLANAR WINGS

F. E. Ehlers and Paul E. Rubbert May 1978 91 p

(Contract NAS2-7729)

(NASA-CR-152126; D6-46373) Avail: NTIS HC A05/MF A01 CSCL 01A

A method is described for solving the linearized supersonic flow over planar wings using panels bounded by two families of Mach lines. Polynomial distributions of source and doublet strength lead to simple, closed form solutions for the aerodynamic influence coefficients, and a nearly triangular matrix yields rapid solutions for the singularity parameters. The source method was found to be accurate and stable both for analysis and design boundary conditions. Similar results were obtained with the doublet method for analysis boundary conditions on the portion of the wing downstream of the supersonic leading edge, but instabilities in the solution occurred for the region containing a portion of the subsonic leading edge. Research on the method was discontinued before this difficulty was resolved. Author

N78-27088# ARO, Inc., Arnold Air Force Station, Tenn.

DEVELOPMENT OF IMPROVED 3DOF ANALYSIS CAPABILITIES IN THE AEDC-VKF CONTINUOUS WIND TUNNELS Final Report, Jul. 1976 - Sep. 1977

M. O. Varner AEDC Apr. 1978 183 p refs

(AD-A053939; AEDC-TR-78-10) Avail: NTIS HC A09/MF A01 CSCL 14/2

This report presents improved data reduction and analysis procedures for 3DOF data from continuous wind tunnels. The Chapman-Kirk method is employed in the development of programs designed to extract aerodynamic coefficients from 3DOF motion. Noise sources inherent in the 3DOF gas bearing measurement system and found in typical test environments are studied. The validity of extracted aerodynamic coefficients in the presence of these noise sources is addressed. Author (GRA)

N78-27089# Ohio State Univ., Columbus. Aeronautical and Astronautical Research Lab.

ADVANCED TWO-PHASE INVESTIGATION IN AN EROSION-ABLATION FACILITY INCLUDING FLOW DIAGNOSTICS Final Technical Report, Jul. 1954 - Dec. 1976

K. D. Korkan, S. L. Petrie, T. S. Rice, and E. McCovey Aug. 1977 99 p refs

(Contract F33615-76-C-3002)

(AD-A053809; AFFDL-TR-77-78) Avail: NTIS HC A05/MF A01 CSCL 20/4

Theoretical and experimental research was conducted to investigate the geometrical and fluid mechanical parameters important in the acceleration of solid particles to hypersonic velocities. A combination-heated erosion-ablation facility providing flows with reservoir enthalpies up to 2000 Btu/lb was assembled and techniques for injecting well-controlled amounts of silicon dioxide particles into the nozzle flow were developed. A laser doppler velocimeter was at the nozzle exit. A digital signal processor capable of measuring particle velocities up to 8000 ft/sec was designed and assembled. Performance characteristics of the various system components are discussed. Author (GRA)

N78-27090# Massachusetts Inst. of Tech., Cambridge.

INITIAL WIND TUNNEL TESTS OF A MANGETICALLY-SUSPENDED SPINNING AND CONING OGIVE CYLINDER Final Report, 1 Sep. 1974 - 31 Dec. 1977

Eugene E. Covert and Charles W. Haldeman Mar. 1978 24 p refs

(Contract DAAG29-75-C-0001)

(AD-A053758; MIT-TR-201; ARO-12209.3-E) Avail: NTIS HC A02/MF A01 CSCL 14/2

Research extending magnetic balance techniques to produce simultaneous spinning and coning motion of a magnetically-suspended wind tunnel model is reported. Initial measurements of the time varying normal force and side force on a model spinning at 100 rps while coning at 2 Hz are reported for coning angles up to 7 degrees and velocities up to 300 ft/sec. Analysis of initial data indicates that improvements in model position sensor stability, balance servo compensation, and data channel filtering will be required to produce data of desired quality. Author (GRA)

N78-27091# National Technical Information Service, Springfield, Va.

LIGHTER THAN AIR VEHICLES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Mar. 1978

Guy E. Habercom, Jr. May 1978 239 p Supersedes NTIS/PS-77/0374

(NTIS/PS-78/0409/9; NTIS/PS-77/0374) Avail: NTIS HC $28.00/MF $28.00 CSCL 01C

An updated bibliography containing 234 abstracts is presented. Design and applications of balloons, dirigibles, and airships were investiagated. Passenger or cargo transport, timbering, tethering, and fabric selection were among the aspects examined. GRA

N78-27066*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LAMINAR FLOW CONTROL OVERVIEW
Ralph J. Muraca *In its* CTOL Transport Technol., 1978 Jun. 1978 p 349-356 (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 01A

N78-27068*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEVELOPMENT OF ADVANCED STABILITY THEORY SUCTION PREDICTION TECHNIQUES FOR LAMINAR FLOW CONTROL
Andrew J. Srokowski *In its* CTOL Transport Technol. 1978 Jun. 1978 p 375-394 refs (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 01A

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N78-27092 Materials Research Labs., Melbourne (Australia).
SAFE AIR-SPACE REQUIREMENTS ABOVE AN EXPLOSIVE-ORDNANCE TEST FACILITY
J. D. Oliver Feb. 1978 16 p refs
(MRL-R-711; AR-000-887) Copyright. Avail: Issuing Activity

Rules are presented which provide reasonably reliable guidance for the prediction of the minimum safe height for aircraft in the vicinity of an explosive-ordnance test facility. G.G.

N78-27093*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
WIND SHEAR MODELING FOR AIRCRAFT HAZARD DEFINITION Final Report, Apr. 1976 - Feb. 1978
Walter Frost (FWG Assoc., Inc.), Dennis W. Camp, and S. T. Wang (FWG Assoc., Inc.) Feb. 1978 256 p
(Contracts NAS8-32217; DOT-FA76WA1-620)
(NASA-TM-79523; AD-A053178; FAA-RD-78-3) Avail: NTIS HC A12/MF A01 CSCL 01C

Mathematical models of wind profiles were developed for use in fast time and manned flight simulation studies aimed at defining and eliminating these wind shear hazards. A set of wind profiles and associated wind shear characteristics for stable and neutral boundary layers, thunderstorms, and frontal winds potentially encounterable by aircraft in the terminal area are given. Engineering models of wind shear for direct hazard analysis are presented in mathematical formulae, graphs, tables, and computer lookup routines. The wind profile data utilized to establish the models are described as to location, how obtained, time of observation and number of data points up to 500 m. Recommendations, engineering interpretations and guidelines for use of the data are given and the range of applicability of the wind shear models is described. G.G.

N78-27094*# California Univ., Berkeley. Institute of Transportation Studies.
AN INVESTIGATION OF SHORT HAUL AIR TRANSPORTATION IN THE SOUTHEASTERN UNITED STATES
Abib Kanafani and Huey-Shin Yuan Jul. 1977 202 p ref
(Grant NsG-2127)
(NASA-CR-152166; UCB-ITS-RR-77-6) Avail: NTIS HC A10/MF A01 CSCL 05C

The specific objectives of this stage of the study are numerous. First, an attempt is made to characterize the travel patterns in the study region, both in terms of origin destination patterns, and connecting and through trip patterns. Second, the structure of the air service in the region is characterized in an attempt to develop an understanding of the evolution of the short haul air transportation network. Finally, a look is taken at the socioeconomic environment of Atlanta and the region in order to seek an explanation for the historic evolution of short haul air travel activities and the rather high growth rates experienced in recent years. G.Y.

N78-27095# National Transportation Safety Board, Washington, D. C.
AIRCRAFT ACCIDENT REPORT: COMMONWEALTH OF PENNSYLVANIA, PIPER PA-31T, N631PT, BRESSLER, PENNSYLVANIA, 14 FEBRUARY 1977
5 Jan. 1978 27 p
(NTISUB/D/104-001; NTSB-AAR-78-1) Avail: NTIS HC A03/MF A01 CSCL 01B

About 0924 e.s.t., on February 24, 1977, a Commonwealth of Pennsylvania, Department of Transportation, Piper PA-31T Cheyenne (N631PT) crashed shortly after takeoff from runway 8 at the Capital City Airport, New Cumberland, Pennsylvania. The aircraft crashed in a populated area in the town of Bressler, a suburb of Harrisburg, Pennsylvania. All occupants of the aircraft, six passengers and two pilots, were killed. A woman was also killed when the house in which she lived was destroyed during the crash. The National Transportation Safety Board determines that the probable cause of the accident was the flightcrew's failure to insure that the aircraft was loaded properly and that its center of gravity was within certificated limits. GRA

N78-27096# Lake Charles-McNeese Urban Observatory, La.
AN AIR PASSENGER AND AIR FREIGHT SERVICE STUDY FOR THE LAKE CHARLES MUNICIPAL AIRPORT AUTHORITY Final Report
John C. Young and Cherry K. Owen 8 Dec. 1977 38 p Prepared in cooperation with League of Cities - Conference of Mayors, Inc., Washington, D. C.
(Contract HUD-H-2196R)
(PB-278857/8; UO-LCCN-LAC-77-017; HUD/RES-1305) Avail: NTIS HC A03/MF A01 CSCL 01B

An area's overall air traffic varies accordingly to many variables; industry, population, highway conditions, proximity to major city, etc. It is concluded that the overall air traffic that is provided to the Lake Charles area by the regional air line, Texas International and the commuter airline, Royal, is good. This conclusion was established by talking with different travel agencies, industry, businessmen, comparing flight schedules with other cities and talking to the individual airlines. The return flights from Houston and New Orleans were studied. It is recommended that the different air lines talk to the U.S. Postal Service in Lake Charles to see if some of the mail can again be sent by air. GRA

N78-27097# General Accounting Office, Washington, D. C. International Div.
THE CRITICAL ROLE OF GOVERNMENT IN INTERNATIONAL AIRTRANSPORT Report to Congress
17 Mar. 1978 109 p
(PB-278503/8; ID-77-50) Avail: NTIS HC A06/MF A01 CSCL 05A

The pervasive role of U.S. and foreign governments in international air transportation matter is described. The U.S. Government efforts are reviewed to implement the provisions of the International Air Transportation Fair Competitive Practices Act of 1974 to respond to discriminatory and unfair practices that are disadvantageous to U.S. carriers. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N78-27098 Texas Univ. at Austin.
PROBLEM-SOLVING WITH SIMULATION IN THE WORLD OF AN AIR TRAFFIC CONTROLLER Ph.D. Thesis
Robert Bell Wesson 1977 245 p

Avail: Univ. Microfilms Order No. 7807407

A theory which suggests an approach to solving time dependent problems was developed. Such problems occur frequently in real world domains and are characterized by the need to perform timely actions based upon incomplete information. If the rules of change reflect how the problem solver's actions modify the world, then simulating the effects of all possible actions and evaluating the predicted outcomes enables an informed choice of the best action to be made. This theory was implemented as a computer program which solved problems occurring in the world of the enroute air traffic controller. A simulation of a typical airspace sector provided the basis for a planning routine which performed the aircraft cordination and separation tasks usually required of professional controllers. Dissert. Abstr.

N78-27099# Toronto Univ. (Ontario). Inst. for Aerospace Studies.

REVIEW OF STRAPDOWN SYSTEMS: KINEMATICS, ALIGNMENT AND STATE ESTIMATION

Hironori Fujii Mar. 1978 31 p refs

(UTIAS-217; CN-ISSN-0082-5263) Avail: NTIS HC A03/MF A01

A brief review is presented on the kinematics, alignment and state estimation of strapdown systems. Emphasis was directed towards error reduction by kinematic formulation, filtering, calibration and reduction in computational burden. Author

N78-27100*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

THE EFFECT OF LANDING SYSTEM COVERAGE AND PATH GEOMETRY ON LATERAL POSITION ERRORS AT THE RUNWAY THRESHOLD

Dan D. Vicroy Jun. 1978 25 p refs

(NASA-TM-78744) Avail: NTIS HC A02/MF A01 CSCL 17G

The results of an analytical study performed to determine the effect of the azimuth coverage of a Microwave Landing System (MLS) on the ability of an airplane, with an initial navigation position estimate error, to navigate to the runway threshold are presented. The test path chosen for this study consists of an initial straight segment leading into a 130 deg turn with a 2286 m radius and ending in a straight-in final approach segment. The test path configuration was varied by changing the MLS azimuth coverage angle and the final approach length. The aircraft was positioned with an inital offset to the left or right of the desired path along the line of intersection with the MLS azimuth coverage. A fast time computer simulation program, using a simplistic point mass model of the airplane, was used for this study. The data from this study indicates that the lateral position errors at the runway are primarily a function of the final approach length. The effect of the azimuth coverage on the lateral position errors was restricted by the turn characteristics of the horizontal steering control laws. G.Y.

N78-27101# Westinghouse Defense and Electronic Systems Center, Baltimore, Md.

STUDY OF ROUGH GROUND AND GRADING CRITERIA FOR ILS GS SITE PREPARATION Interim Report

G. J. Moussally, R. A. Moore, J. T. Godfrey, and H. F. Hartley Mar. 1978 68 p refs

(Contract DOT-FA74WA-3353)

(AD-A053294; FAA-RD-78-42) Avail: NTIS HC A04/MF A01 CSCL 01/5

The scattering of electromagnetic radiation from rough surfaces was studied. The diffuse and specular components of the scattered field were treated separately. Current grading of ILS sites requires rather stringent preparation of the ground. Criteria are developed that reflect the statistical nature of the disturbance in observed signal rather than simply to consider the maximum allowable phase differences as the basis for establishing a grading criterium. G.G.

N78-27102# Federal Aviation Administration, Washington, D. C. Systems Research and Development Service.

A COMPARISON OF MEASURED DATA AND ITS MODEL PREDICTIONS: VOR AND TACAN SIGNAL STRENGTHS Final Report

Robert D. Smith Jan. 1978 284 p refs

(AD-A053265; FAA-RD-77-106) Avail: NTIS HC A13/MF A01 CSCL 17/7

The Institute of Telecommunication Sciences (ITS) has developed for the Federal Aviation Administration (FAA) a computer model (IF-77) which predicts signal strengths, desired-to-undesired signal ratios, and a variety of other radio propagation related outputs. The model is periodically updated as ITS improves its prediction capability. The model was last validated by FAA about 10 years ago. Since a number of changes have been made to the model since then, revalidation is not inappropriate. In this report, propagation predictions are compared with VOR and TACAN signal strength measurements taken on 20 VORTAC's in the Southwest Region of the United States. This comparison confirms once again, that the ITS/FAA accurately predicts VOR and TACAN signal strength. Author

N78-27103# National Aviation Facilities Experimental Center, Atlantic City, N. J.

COMPARISON OF SLANT AND RUNWAY VISUAL RANGE RELATIONSHIPS FOR 100, 124, AND 155 FEET Final Report, May 1977 - Jul. 1977

William Lewis Apr. 1978 18 p refs

(FAA Proj. 151-462-060)

(AD-A052870; FAA-NA-78-1; FAA-RD-77-191) Avail: NTIS HC A02/MF A01 CSCL 17/7

Ratios of slant visual range measured from heights of 100, 124, and 155 feet to horizontal visual range measured at 15 feet were computed for low-visibility regimes. These ratios were found to be related to the linear fog density profile expressed as the difference in horizontal atmospheric transmittance between the top (100, 124, and 155 foot) and bottom (15 foot) levels. Useful estimates of slant visual range can be provided through these relationships. The predictions would be most accurate when the visibility decreased with height (most common fog structure). A slight increase in accuracy would also be expected with decreasing slant height. A.R.H.

N78-27104# National Aviation Facilities Experimental Center, Atlantic City, N. J. Systems Test Branch.

LAS VEGAS GRAPHIC STUDY Final Report, Jan. - Feb. 1977

John J. Maurer, Victor J. Misiewicz, and Robert W. Tack Jan. 1978 128 p

(AD-A052772; FAA-NA-77-27; FAA-RD-77-182) Avail: NTIS HC A07/MF A01 CSCL 17/7

A number of new procedural plans for the control of air traffic operating within the Las Vegas terminal area are reported. A plan was also developed for a head-on type departure/arrival operation for Nellis Air Force Base. A controller opinion questionnaire was developed that take into consideration the users, controllers, and the area. Each plan was evaluated by a panel of 14 air traffic control specialists. The new plans for the terminal area, along with the present operating procedures, were evaluated for each of four directions of operation or runway configurations and then statistically compared with each other. The results indicate that, overall, plans 1 and 2 were significantly preferred over the present system and plan 2 was also significantly preferred over plan 1. The present system at Nellis AFB was significantly preferred over plan 3 (head-on procedures). Basic reasons for the choice of the Nellis present system over the head-on procedure were safety, complexity of operation, controller workload, and adverse effects to missions due to delays. G.G.

N78-27105*# Analytical Mechanics Associates, Inc., Mountain View, Calif.

DEVELOPMENT AND FLIGHT TESTS OF A KALMAN FILTER FOR NAVIGATION DURING TERMINAL AREA AND LANDING OPERATIONS

Stanley F. Schmidt, Paul F. Flanagan, and John A. Sorenson Jul. 1978 136 p refs

(Contract NAS2-8862)

(NASA-CR-3015) Avail: NTIS HC A07/MF A01 CSCL 17G

A Kalman filter for aircraft terminal area and landing navigation was implemented and flight tested in the NASA Ames STOLAND avionics computer onboard a Twin Otter aircraft. This system combines navaid measurements from TACAN, MODILS, air data, radar altimeter sensors along with measurements from strap-down accelerometer and attitude angle sensors. The flight

test results demonstrate that the Kalman filter provides improved estimates of the aircraft position and velocity as compared with estimates from the more standard complementary filter. The onboard computer implementation requirements to achieve this improved performance are discussed. Author

N78-27106# Facility Checking Squadron (1866th) (AFCS), Scott AFB, Ill.

TRACALS EVALUATION REPORT. COMMUNICATIONS STATION EVALUATION REPORT, LITTLE ROCK AFB, ARKANSAS Final Report

Kenneth G. Mason 17 Apr. 1978 63 p
(AD-A053938; Rept-78/66C-116) Avail: NTIS HC A04/MF A01 CSCL 17/7

A Traffic Control and Landing System (TRACALS) Communications Station Evaluation was performed at Little Rock AFB, Arkansas (2151 Comm Sq) from 17-27 January 1978. The purpose of the evaluation was to define the capabilities and limitations of the communications system servicing the ground control approach (GCA) and control tower. Included in this report are the results and analysis of equipment checks, system line level diagrams, line-of-sight coverage, data analysis of airborne measurements of signal strength, and plots of UHF and VHF radiations patterns. Other items which are discussed in this report, and are common problems with most other systems, include system alignment procedures and antenna maintenance problems. The data and diagrams used in this report can be used as a guide for anticipated performance of the communication system at Little Rock AFB until there is a deletion, addition, relocation of equipment, or a change in horizon profile which would affect the system. Author (GRA)

N78-27107# Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio.

OUT OF CONTAINER HANDLING ANALYSIS OF THE LN-15 INERTIAL MEASUREMENT UNIT

Frank C. Jarvis Mar. 1978 15 p
(AD-A053448; PTPT-78-6) Avail: NTIS HC A02/MF A01 CSCL 17/7

The purpose of this study was to analyze the 'out of container' handling procedures of the LN-15 Inertial Measurement Unit (IMU). Unserviceable IMUs were being received by Air Force maintenance organizations which resulted in requests for container evaluation. During the container testing phase, problems were encountered while attempting to remove the IMU from the inner container of the test pack. This container had to be turned on its side to remove the IMU because the top section of the polyethylene insert separated at the bonded joint and the IMU could not be lifted from the container. As a result of this awkward maneuver it was recognized that damage to the IMU could occur if it came in contact with a hard surface. An out of container test plan was implemented and a series of non-standard tests were conducted. The results revealed some significant shock input information which should be of value to all personnel responsible for handling and installing delicate IMUs.
Author (GRA)

N78-27108# Oregon State Univ., Corvallis.

TERMINATION OF LORAN-A. AN EVALUATION OF ALTERNATIVE POLICIES

Daniel A. Panshin, Rebecca S. Roberts, and Charles Vars, Jr. Oct. 1977 142 p refs
(PB-279593/8; ORESU-T-77-008; NOAA-78021505) Avail: NTIS HC A07/MF A01 CSCL 17G

Problems for U.S. civilian mariners associated with termination of Loran-A service were identified. The benefits and costs of possible Coast Guard actions to lessen the adverse impact of termination were measured and evaluated. GRA

N78-27109# Advisory Group for Aerospace Research and Development, Paris (France).

TECHNICAL EVALUATION REPORT ON THE 24TH GUIDANCE AND CONTROL PANEL TECHNICAL MEETING: SYMPOSIUM ON APPLICATIONS OF ADVANCES IN NAVIGATION TO GUIDANCE AND CONTROL

Jun. 1978 11 p ref Symp. held at Stuttgart, 10-13 May 1977
(AGARD-AR-115) Avail: NTIS HC A02/MF A01

A symposium was held to study advances in navigational techniques with relation to guidance and control. Specific topics of discussion were some of the following: (1) improvements in inertial navigation systems and their applications; (2) improvements in radar and radio navigation aids; and (3) major systems, specific functions and concepts. B.B.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N78-27110 Stanford Univ., Calif.

GUIDANCE LOGIC FOR DECELERATING SPIRAL APPROACH OF A TILT-ROTOR AIRCRAFT IN THE PRESENCE OF WIND Ph.D. Thesis

Jacques Beser 1978 201 p
Avail: Univ. Microfilms Order No. 7808764

The nominal control commands necessary to fly a steady, descending turn (or straight segment) were calculated and additional commands required for deviation in descent rate, deceleration and flight in a steady wind were determined. Feedback control commands proportional to the difference between the estimated state and the nominal state were added to the nominal commands. The gain matrix was piece-wise constant, i.e., constant for each of the eight reference models used during the approach. Simulations of approach flights for different mean winds and random gusts strengths, assuming perfect state information in the feedback signal, indicated satisfactory performance.
Dissert. Abstr.

N78-27111*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

GROUND-BASED AND IN-FLIGHT SIMULATOR STUDIES OF LOW-SPEED HANDLING CHARACTERISTICS OF TWO SUPERSONIC CRUISE TRANSPORT CONCEPTS

William D. Grantham, Luat T. Nguyen, Perry L. Deal, M. J. Neubauer, Paul M. Smith (Vought Corporation Hampton Technical Center, Hampton, Va.), and Frederick D. Gregory Jul. 1978 101 p refs
(NASA-TP-1240; L-12165) Avail: NTIS HC A06/MF A01 CSCL 01C

Conventional and powered lift concepts for supersonic approach and landing tasks are considered. Results indicated that the transport concepts had unacceptable low-speed handling qualities with no augmentation, and that in order to achieve satisfactory handling qualities, considerable augmentation was required. The available roll-control power was acceptable for the powered-lift concept. G.G.

N78-27112# National Aviation Facilities Experimental Center, Atlantic City, N. J.

GENERAL AVIATION (FAR 23) COCKPIT STANDARDIZATION ANALYSIS Final Report, Jul. 1976 - Jan. 1977

Robert J. Ontiveros, Roman M. Spangler, and Richard L. Sulzer Mar. 1978 113 p refs
(AD-A052803; FAA-NA-77-38) Avail: NTIS HC A06/MF A01 CSCL 01/3

Cockpit design features amenable to standardization in small general aviation aircraft were studied with the goal of increasing safety. A list of 101 cockpit design features was presented to 82 experienced pilots who indicated where they believed increased standardization was warranted. Features cited by half or more of the pilots were studied further and reduced to nine design areas considered to warrant near-term action. Selection of these areas was based on analysis of accident reports and practicality considerations in addition to pilot comments. Three of the design areas relate to the cockpit functions of housing and protecting the pilot (improved body restraint system, more positive action and positive latching of adjustable pilot seats, and door latching with a visible locked state). The remaining six areas relate to the other major cockpit function of providing the man-machine interface required to operate the aircraft (fuel management system,

powerplant controls, flight instruments, powerplant instruments, instrument lighting, and electrical circuit breakers). Separate sections of the report summarize the data assembled to justify the recommendation for standardization actions in each of the nine areas. Author

N78-27113*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
APPLICATION OF SPECIAL-PURPOSE DIGITAL COMPUTERS TO ROTORCRAFT REAL-TIME SIMULATION
D. Brain Mackie and Seth Michelson (Computer Sci. Corp., Mountain View, Calif.) Jul. 1978 37 p refs
(NASA-TP-1267; A-7343) Avail: NTIS HC A03/MF A01 CSCL 01C

The use of an array processor as a computational element in rotorcraft real-time simulation is studied. A multilooping scheme was considered in which the rotor would loop over its calculations a number of time while the remainder of the model cycled once on a host computer. To prove that such a method would realistically simulate rotorcraft, a FORTRAN program was constructed to emulate a typical host-array processor computing configuration. The multilooping of an expanded rotor model, which included appropriate kinematic equations, resulted in an accurate and stable simulation. G.G.

N78-27114# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
MODAL INVESTIGATION OF LIGHTWEIGHT AIRCRAFT STRUCTURES USING DIGITAL TECHNIQUES Final Report, Feb. 1974 - Mar. 1976
Robert W. Gordon, Howard F. Wolfe, and Richard D. Talmadge Dec. 1977 66 p refs
(AD-A053782; AFFDL-TR-77-124) Avail: NTIS HC A04/MF A01 CSCL 20/11

Digital impact response test techniques were used to measure the dynamic properties of lightweight aircraft structures to include natural frequencies, mode shapes and modal damping. Two different types of structures were tested, honey-comb and skin-stiffened panels. The digital impact response method used consisted of applying a transient force pulse to the structure, measuring the structure's response at various points, digitizing, calculating the transfer functions using fast Fourier transforms, and determining the dynamic properties from these data. A second method was used on these same structures for direct comparison purposes. This method was an analog technique using sine sweep tests and accelerometer mapping. The comparison indicated close agreement in the results. The use of the digital technique has resulted in a considerable savings in the manhours required to obtain the dynamic properties of the structures. Author (GRA)

N78-27115# Boeing Aerospace Co., Seattle, Wash.
ADAPTIVE LANDING GEAR FOR IMPROVED TAXI PERFORMANCE Final Technical Report, Jan. 1976 - Sep. 1977
P. T. Somm, H. H. Straub, and J. R. Kilner Oct. 1977 70 p
(Contract F33615-76-C-3004; AF Proj. 1369)
(AD-A053733; D180-20795-1; AFFDL-TR-77-119) Avail: NTIS HC A04/MF A01 CSCL 01/3

Taxi performance in terms of airplane CG acceleration for the KC-135, T-43A, and YC-14 type main gear are calculated with a digital simulation. Simple landing gear oleo modifications, such as bypass orifices and dual stage air chambers, are proposed and evaluated and reduce CG (RMS) acceleration by as much as 47%. Improved taxi performance also results in reduced gear loads when bomb crater repair patches are encountered with the KC-135 and YC-14 type gear. Fatigue damage due to taxi on austere fields decreases by 6% or more. However, fatigue damage due to taxi on prepared fields is not affected by the proposed oleo modification. Author (GRA)

N78-27116# General Accounting Office, Washington, D. C. Procurement and Systems Acquisition Div.
IS PRODUCTION OF THE CH-53E HELICOPTER WARRANTED Report to the Congress
23 Mar. 1978 36 p
(PB-278815/6; PSAD-78-27) Avail: NTIS HC A03/MF A01 CSCL 01C

The CH-53E is being developed to provide a shipboard compatible helicopter with double lift capability. Testing and program costs are discussed in detail. GRA

N78-27063*# Douglas Aircraft Co., Inc., Santa Monica, Calif.
KEY ISSUES IN APPLICATION OF COMPOSITES TO TRANSPORT AIRCRAFT
M. Stone *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 281-310 refs (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 01C

N78-27064*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ADVANCED STRUCTURAL SIZING METHODOLOGY
W. Jefferson Stroud and Jaroslaw Sobieszczanski-Sobieski *In its* CTOL Transport Technol., 1978 Jun. 1978 p 311-330 refs (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 01C

N78-27065*# Boeing Commercial Airplane Co., Seattle, Wash.
TRANSITION FROM GLASS TO GRAPHITE IN MANUFACTURE OF COMPOSITE AIRCRAFT STRUCTURE
Harvey E. Buffum and Vere S. Thompson *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 331-347 (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 01C

N78-27067*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLIGHT INVESTIGATION OF INSECT CONTAMINATION AND ITS ALLEVIATION
John B. Peterson, Jr. and David F. Fisher *In its* CTOL Transport Technol., 1978 Jun. 1978 p 357-373 refs (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 01C

N78-27069*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESIGN OF A LAMINAR-FLOW-CONTROL SUPERCRITICAL AIRFOIL FOR A SWEPT WING
Dennis O. Allison and John R. Dagenhart *In its* CTOL Transport Technol., 1978 Jun. 1978 p 395-408 refs (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 01C

N78-27070*# Boeing Commercial Airplane Co., Seattle, Wash.
APPLICATION OF LAMINAR FLOW CONTROL TECHNOLOGY TO LONG-RANGE TRANSPORT DESIGN
L. B. Gratzer and D. George-Falvy *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 409-447 refs (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 01C

N78-27071*# Lockheed-Georgia Co., Marietta.
TOWARD A LAMINAR-FLOW-CONTROL TRANSPORT
R. F. Sturgeon *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 449-495 refs (For primary document see N78-27046 18-01)
(Contract NAS1-14631)
Avail: NTIS HC A22/MF A01 CSCL 01C

N78-27072*# Douglas Aircraft Co., Inc., Santa Monica, Calif.
APPLICATION OF POROUS MATERIALS FOR LAMINAR FLOW CONTROL
Wilfred E. Pearce *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 497-522 refs (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 01C

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N78-27117# Air Force Geophysics Lab., Hanscom AFB, Mass.
AN AUTORANGING BALLOON ALTIMETER: A SINGLE PRESSURE TRANSDUCER MONITORS ALTITUDE FROM 0 TO 44 KILOMETERS WITH 30 METERS RESOLUTION Final Report
Robert H. Cordella, Jr. 26 Jan. 1978 102 p refs
(AD-A053730; AFGL-TR-78-0023; AFGL-IP-262) Avail: NTIS HC A06/MF A01 CSCL 01/3

This report documents a method of determining altitude based on the atmospheric pressure using the U.S. Standard Atmosphere, 1976 to model the pressure vs altitude profile. A precision pressure transducer facilitates the design, which is described in increasing levels of completeness from the basic block diagram to 'as built' schematics and pictures. The design algorithm, supporting firmware and software, is presented and explained. Test results confirm the design calculations and validate the altimeter's accuracy and resolution. Author (GRA)

N78-27118# Vought Corp., Dallas, Tex.
APPLICATION OF AIDS TO THE A-7E AND A PROJECTED FUTURE TACTICAL AIRCRAFT Final Report, Jun. - Dec. 1977
P. E. Greer and J. R. Hanking Dec. 1977 145 p refs
(Contract N62269-77-C-0186)
(AD-A053775; Rept-2-37100/7R-3442; NADC-78032-60) Avail: NTIS HC A07/MF A01 CSCL 01/3

A study program to evaluate the application of the AIDS concept to the A-7E as well as a future tactical aircraft has been completed. The study evaluated the physical characteristics of the AIDS as applied to the A-7E and selected the Type 'A' V/STOL as the future tactical aircraft to evaluate physical compatibility, interface requirements, display format analysis, cockpit ambient lighting, and unique display system requirements associated with the V/STOL application. The study results reported in this document verify the feasibility of utilizing the integrated display concept in the A-7E aircraft as well as the Type 'A' V/STOL. Certain physical incompatibilities were noted for the V/STOL application with regard to component sizes, and several unique display requirements are identified relative to V-mode operations. Author (GRA)

N78-27119# National Bureau of Standards, Washington, D. C. Applied Mathematics Div.
PROBLEMS IN WORLD-WIDE STANDARDIZATION OF THE UNITS OF ALTITUDE MEASUREMENT
Judith F. Gilsinn Feb. 1978 25 p refs
(Contract DOT-FA76WAI-594)
(PB-277982/5; NBSIR-77-1386) Avail: NTIS HC A02/MF A01 CSCL 01D

The United States commitment to a voluntary conversion to metric units raises changeover problems in the fields of air traffic control and airspace management. Current practice in altitude measurement and the rules for height maintenance in effect worldwide are discussed. Desirable features are given for an altitude measurement system, encompassing both the units of height measurement and the designation of cruising levels. Alternative bases for the design of such a system are summarized and related to the desirable characteristics. Problems associated with each of the approaches are presented and the many factors to be considered and interrelationships involved examined. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N78-27120 Case Western Reserve Univ., Cleveland, Ohio.
IDENTIFICATION AND MEASUREMENT OF COMBUSTION NOISE FROM A TURBOFAN ENGINE USING CORRELATION AND COHERENCE TECHNIQUES Ph.D. Thesis
Allen Martin Karchmer 1978 156 p
Avail: Univ. Microfilms Order No. 78-09288

Fluctuating pressure measurements within the combustor and tailpipe of a turbofan engine were made simultaneously with far field acoustic measurements. The pressure measurements within the engine were accomplished with cooled semi-infinite waveguide probes utilizing conventional condenser microphones as the transducers. The measurements were taken over a broad range of engine operating conditions and for sixteen far field microphone positions between 10 deg and 160 deg relative to the engine inlet axis. Correlation and coherence techniques were used to determine the relative phase and amplitude relationships between the internal pressures and far field acoustic pressures. The results indicate that the combustor is a low frequency source region for acoustic propagation through the tailpipe and out to the far field. Dissert. Abstr.

N78-27121* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TWO DIMENSIONAL WEDGE/TRANSLATING SHROUD NOZZLE Patent
Donald L. Maiden, inventor (to NASA) Issued 9 May 1978 9 p Filed 31 Mar. 1976 Supersedes N76-22202 (14 - 13, p 1618)
(NASA-Case-LAR-11919-1; US-Patent-4,088,270; US-Patent-Appl-SN-672221; US-Patent-Class-239-265.25; US-Patent-Class-60-230; US-Patent-Class-239-265.33) Avail: US Patent Office CSCL 21E

A jet propulsion exhaust nozzle is reported for multi-engine installations which produces high internal/external, thrust-minus-drag, performance for transonic cruise or transonic acceleration as well as improved performance at subsonic and supersonic speeds. A two dimensional wedge/translating shroud provides the variable nozzle exit geometry needed to achieve high engine performance over a wide range of throttle power settings. Official Gazette of the U.S. Patent Office

N78-27122*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUPERCRITICAL FUEL INJECTION SYSTEM Patent Application
C. J. Marek and L. P. Cooper, inventors (to NASA) Filed 19 Jun. 1978 10 p
(NASA-Case-LEW-12990-1; US-Patent-Appl-SN-916654) Avail: NTIS HC A02/MF/A01 CSCL 21E

A fuel injection system for gas turbines or the like which includes a pair of high pressure pumps which provide fuel and a carrier fluid such as air at pressures above the critical pressure of the fuel was developed. A supercritical mixing chamber mixes the fuel and carrier fluid and the mixture is sprayed into a combustion chamber for burning therein. The use of fuel and a carrier fluid at supercritical pressures promotes rapid mixing of the fuel in the combustion chamber so as to reduce the formation of pollutants and promote cleaner burning. NASA

N78-27123# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
A TRANSONIC PROPELLER OF TRIANGULAR PLAN FORM: AN EXTENSION
Herbert S. Ribner May 1978 29 p refs
(UTIAS-TN-218; CN-ISSN-0082-5263) Avail: NTIS HC A03/MF A01

An isosceles triangle twisted into a screw surface about its axis was proposed as a propeller for transonic flight speeds. The mathematical analysis is extended to cover aerodynamic and structural effects of a feasible camber distribution. The basic camber is localized near the leading edge; the camber is determined in such a way that the theoretical infinite pressure peak along the leading edge is eliminated. An auxiliary camber or rake is derived for the alleviation of the deflection caused by the centrifugal forces. The earlier formulas were derived on the assumption that the triangle is narrow compared with the Mach cone from its vertex. A factor to correct approximately for the breadth of the triangle is introduced herein. The selection of the advance-diameter coefficient and pitch-diameter ratio for maximum efficiency is treated. Finally, the design of a 3.5 foot

diameter model propeller for wind-tunnel tests at a stream Mach number of 0.9 is carried through in a numerical example. G.G.

N78-27124*# Boeing Commercial Airplane Co., Seattle, Wash.
JT9D ENGINE DIAGNOSTICS. TASK 2: FEASIBILITY STUDY OF MEASURING IN-SERVICE FLIGHT LOADS
P. G. Kafka, M. A. Skibo, and J. L. White 15 Oct. 1977 68 p refs
(Contract NAS3-20632)
(NASA-CR-135395; D6-44664) Avail: NTIS HC A04/MF A01 CSCL 21E

The feasibility of measuring JT9D propulsion system flight inertia loads on a 747 airplane is studied. Flight loads background is discussed including the current status of 747/JT9D loads knowledge. An instrumentation and test plan is formulated for an airline-owned in-service airplane and the Boeing-owned RA001 test airplane. Technical and cost comparisons are made between these two options. An overall technical feasibility evaluation is made and a cost summary presented. Conclusions and recommendations are presented in regard to using existing inertia loads data versus conducting a flight test to measure inertia loads.
Author

N78-27125*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INLET-ENGINE MATCHING FOR SCAR INCLUDING APPLICATION OF A BICONE VARIABLE GEOMETRY INLET
Joseph F. Wasserbauer and William H. Gerstenmaier 1978 23 p refs Presented at the 14th Propulsion Conf., Las Vegas, Nev., 25-27 Jul. 1978; cosponsored by the AIAA and the SAE Engr.
(NASA-TM-78955; E-9706) Avail: NTIS HC A02/MF A01 CSCL 21E

Airflow characteristics of variable cycle engines (VCE) designed for Mach 2.32 can have transonic airflow requirements as high as 1.6 times the cruise airflow. This is a formidable requirement for conventional, high performance, axisymmetric, translating centerbody mixed compression inlets. An alternate inlet is defined, where the second cone of a two cone center body collapses to the initial cone angle to provide a large off-design airflow capability, and incorporates modest centerbody translation to minimize spillage drag. Estimates of transonic spillage drag are competitive with those of conventional translating centerbody inlets. The inlet's cruise performance exhibits very low bleed requirements with good recovery and high angle of attack capability.
Author

N78-27126*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A COMPUTER PROGRAM FOR FULL-COVERAGE FILM-COOLED BLADING ANALYSIS INCLUDING THE EFFECTS OF A THERMAL BARRIER COATING
Jun. 1978 11 p refs To be presented at the Winter Ann. Meeting of ASME, San Francisco, 10-15 Dec. 1978
(NASA-TM-78951; AVRADCOM-TR-78-31(PL); E-9696) Avail: NTIS HC A02/MF A01 CSCL 21E

The program input, coolant flow and heat transfer model, and the program output are discussed. As an example, sections of the suction and pressure sides of a high temperature, high pressure turbine vane are analyzed to show the effects of a thermal barrier coating. Compared to the uncoated design, the coating halves the required coolant flow, while simultaneously reducing metal outer temperatures by over 111 K.
Author

N78-27127*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FUEL CONSERVATIVE AIRCRAFT ENGINE TECHNOLOGY
Donald L. Nored 1978 39 p refs Proposed for presentation at 11th Congr. of the Intern. Council of Aeronautical Sci., Lisbon, Portugal, 10-16 Sep. 1978; sponsored by AIAA
(NASA-TM-78962; E-9719) Avail: NTIS HC A03/MF A01 CSCL 21E

Technology developments for more fuel-efficiency subsonic transport aircraft are reported. Three major propulsion projects were considered: (1) engine component improvement - directed at current engines; (2) energy efficient engine - directed at new turbofan engines; and (3) advanced turboprops - directed at technology for advanced turboprop-powered aircraft. Each project is reviewed and some of the technologies and recent accomplishments are described.
G.G.

N78-27128*# Hamilton Standard, Windsor Locks, Conn.
PROP-FAN DATA SUPPORT STUDY Final Report
J. A. Baum, P. J. Dumais, M. G. Mayo, F. B. Metzger, A. M. Shenkman, and G. G. Walker 28 Feb. 1978 111 p
(Contract NAS2-9750)
(NASA-CR-152141) Avail: NTIS HC A06/MF A01 CSCL 01C

Updated parametric prop-fan data packages are presented and the rationale used in developing the new prop-fan data is detailed. These data represent Hamilton Standard's projections of prop-fan characteristics for aircraft that are expected to be in-service in the 1985 to 1990 time frame. The basic prop-fan configuration was designed for efficient cruise operation at 0.8 Mach number and 10,668M altitude. The design blade tip speed is 244 mps and the design power loading is 301 KW/M squared.
G.G.

N78-27129*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
FABRICATION AND TEST OF DIGITAL OUTPUT INTERFACE DEVICES FOR GAS TURBINE ELECTRONIC CONTROLS Final Report
D. M. Newirth and E. W. Koenig May 1978 59 p
(Contract NAS3-19898)
(NASA-CR-135427; PWA-5544-13) Avail: NTIS HC A04/MF A01 CSCL 21E

A program was conducted to develop an innovative digital output interface device, a digital effector with optical feedback of the fuel metering valve position, for future electronic controls for gas turbine engines. A digital effector (on-off solenoids driven directly by on-off signals from a digital electronic controller) with optical position feedback was fabricated, coupled with the fuel metering valve, and tested under simulated engine operating conditions. The testing indicated that a digital effector with optical position feedback is a suitable candidate, with proper development for future digital electronic gas turbine controls. The testing also identified several problem areas which would have to be overcome in a final production configuration.
Author

N78-27130*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REVERSE-FLOW COMBUSTOR FOR SMALL GAS TURBINES WITH PRESSURE-ATOMIZING FUEL INJECTORS
Carl T. Norgren, Edward J. Mularz (AVRADCOM Res. and Technol. Labs.), and Stephen M. Riddlebaugh Aug. 1978 30 p refs
(NASA-TP-1260; AVRADCOM-TR-78-22(PL); E-9458) Avail: NTIS HC A03/MF A01 CSCL 21E

A reverse flow combustor suitable for a small gas turbine (2 to 3 kg/s mass flow) was used to evalute the effect of pressure atomizing fuel injectors on combustor performance. In these tests an experimental combustor was designed to operate with 18 simplex pressure atomizing fuel injectors at sea level takeoff conditions. To improve performance at low power conditions, fuel was redistributed so that only every other injector was operational. Combustor performance, emissions, and liner temperature were compared over a range of pressure and inlet air temperatures corresponding to simulated idle, cruise, and takeoff conditions typical of a 16 to 1 pressure ratio turbine engine.
B.B.

N78-27131# Civil and Environmental Engineering Development Office, Tyndall AFB, Fla.
PHOTOGRAPHIC MEASUREMENTS OF USAF AIRCRAFT PLUME RISE Final Report, 1 Jul. - 22 Nov. 1977
Paul D. Music, John S. Hunt, and Dennis F. Naugle Nov. 1977 35 p refs
(AD-A054004; CEEDO-TR-77-57) Avail: NTIS HC A03/MF A01 CSCL 04/1

This report includes data and results which were obtained during plume rise experimentation. Aircraft plumes were photographed using the smoke-producing F-102 drones, and Thunderbird T-38 aircraft. The second set of experiments indicated that, under low wind and unstable conditions, the aircraft plume not only rises but completely separates from the ground. The

other studies, however, indicate that under high wind and neutral conditions, the plume rise is greatly retarded and there is no significant ground separation. Differences in micrometeorology apparently account for these plume rise variations. Since the 13 tests performed are inadequate to understand the causes for the plume rise and ground separation, it is recommended that this study be extended in order to provide an explanation for this phenomenon. GRA

N78-27132# Civil and Environmental Engineering Development Office, Tyndall AFB, Fla. Detachment 1 ADTC.
SUBISOKINETIC SAMPLING ERRORS FOR AIRCRAFT TURBINE ENGINE SMOKE PROBES Final Report, 15 Sep. 1977 - 15 Jan. 1978
Joseph A. Martone Apr. 1978 21 p refs
(AD-A053867; CEEDO-TR-78-20) Avail: NTIS HC A02/MF A01 CSCL 21/5

Experimental evidence that isokinetic sampling can be important for submicrometer particles in high speed flows was presented in CEEDO-TR-77-48. This report applies those results to gas turbine engine smoke measurement. The analysis predicts a 15 to 30 percent subisokinetic sampling error at a take-off engine power setting. It is concluded that subisokinetic errors do not greatly affect smoke number determinations but should be considered when true smoke density is measured.
Author (GRA)

N78-27133# Naval Air Test Center, Patuxent River, Md.
AIRCRAFT ENGINE DRIVEN ACCESSORY SHAFT COUPLING IMPROVEMENTS USING HIGH-STRENGTH NONMETALLIC ADAPTER/BUSHINGS Progress Report
Aleck Loker 31 Mar. 1978 41 p refs
(AD-A053834; NATC-TM-78-1-SY) Avail: NTIS HC A03/MF A01 CSCL 21/5

Engine driven accessories, such as generators, starters, and pumps, are commonly connected to their respective power takeoff shafts by spline couplings. These shaft couplings, which allow rapid installation and removal of the accessory, are capable of high torque transmission and are considered to be selfcentering. this Technical memorandum presents information pertaining to manufacturing techniques, contains previously unpublished test data, and includes all of the new spline designs produced and evaluated by NAVAIRTESTIGEN. Extensive laboratory testing and 40,000 hr of flight on six aircraft types have demonstrated the value of the new spline designs. Some of the benefits of the new coupling technique are; (1) higher accessory power system reliability, (2) elimination of wear and premature failure, (3) reclamation of gearboxes at the organizational level, and (4) reduction of maintenance induced failures. A series of nonmetallic couplings are available for a large number of accessory equipment applications due to the expanding size/rating range of coupling designs. GRA

N78-27134# Naval Postgraduate School, Monterey, Calif.
COMBUSTOR DESIGN AND OPERATION FOR A SUB-SCALE TURBOJET TEST CELL M.S. Thesis
Jerry Russell Charest Mar. 1978 44 p refs
(AD-A053791) Avail: NTIS HC A03/MF A01 CSCL 21/5

A high pressure, water-cooled ramjet-type combustor capable of producing various amounts of particulates has been designed, constructed and operated in the sub-scale turbojet test cell. The combustor can be utilized to perform further studies concerning the effects of engine operating characteristics and test cell design on particulate concentrations, and also the effects of fuel additives on the amount and composition of particulates emitted. Author (GRA)

N78-27135# Advisory Group for Aerospace Research and Development, Paris (France).
TECHNICAL EVALUATION REPORT ON THE 50TH MEETING OF THE PROPULSION AND ENERGETICS PANEL: A SYMPOSIUM ON HIGH TEMPERATURE PROBLEMS IN GAS TURBINE ENGINES
R. Eggebrecht (MTU GmbH, Munich) and S. Lombardo (Curtiss-Wright Corp., Wood-Ridge, N. J.) Mar. 1978 19 p ref Symp. held at Ankara, 19-23 Sep. 1977
(AGARD-AR-116) Avail: NTIS HC A02/MF A01

A symposium was held to review the main problems associated with the attainment of high temperatures in aircraft gas turbine engines. Specific topics examined were the following: (1) turbine cooling techniques; (2) combustors, afterburners and nozzles; (3) materials and coatings; (4) effect of cooling on aerodynamic performances; and (5) prediction methods. B.B.

N78-27048*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ACEE PROPULSION OVERVIEW
Donald L. Nored *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 9-23 refs (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 21E

N78-27049*# General Electric Co., Fairfield, Conn.
CF6 JET ENGINE PERFORMANCE DETERIORATION RESULTS
R. J. Lewis, C. E. Humerickhouse, and J. E. Paas *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 25-44 refs (For primary document see N78-27046 18-01) (Contract NAS3-20631)
Avail: NTIS HC A22/MF A01 CSCL 21E

N78-27050*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
JT9D JET ENGINE PERFORMANCE DETERIORATION
A. Jay, E. S. Todd, and G. P. Sallee *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 45-58 (For primary document see N78-27046 18-01)
(Contract NAS3-20632)
Avail: NTIS HC A22/MF A01 CSCL 21E

N78-27051*# General Electric Co., Fairfield, Conn. Aircraft Engine Group.
CF6 PERFORMANCE IMPROVEMENT
Dean J. Lennard *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 59-78 (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 21E

N78-27052*# Pratt and Whitney Aircraft Group, East Hartford, Conn.
ENGINE COMPONENT IMPROVEMENT: JT8D AND JT9D PERFORMANCE IMPROVEMENTS
W. O. Gaffin *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 79-80 ref (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 21E

N78-27053*# Pratt and Whitney Aircraft Group, East Hartford, Conn.
ENERGY EFFICIENT ENGINE: PRELIMINARY DESIGN AND INTEGRATION STUDIES
David E. Gray *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 89-110 (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 21E

N78-27054*# General Electric Co., Fairfield, Conn.
ENERGY EFFICIENT ENGINE PRELIMINARY DESIGN AND INTEGRATION STUDIES
R. P. Johnston and M. C. Hemsworth *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 111-138 refs (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 21E

N78-27055*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STATUS OF ADVANCED TURBOPROP TECHNOLOGY
J. F. Dugan, B. A. Miller, and D. A. Sagerser *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 139-166 refs (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 21E

N78-27056*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROPULSION SYSTEMS NOISE TECHNOLOGY
C. E. Feiler *In* NASA. Langley Res. Center CTOL Transport

Technol., 1978 Jun. 1978 p 167-185 refs (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 21E

N78-27057*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADVANCED MATERIALS RESEARCH FOR LONG-HAUL AIRCRAFT TURBINE ENGINES
R. A. Signorelli and C. P. Blankenship *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 187-204 refs (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 21E

N78-27058*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GAS TURBINE ENGINE EMISSION REDUCTION TECHNOLOGY PROGRAM
Donald A. Petrash and Larry A. Diehl *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 205-216 (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 21E

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N78-27136*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF A FIGHTER MODEL WITH A CLOSE-COUPLED CANARD AT MACH NUMBERS FROM 0.40 TO 1.20
Richard J. Re and Francis J. Capone Jul. 1978 80 p refs
(NASA-TP-1206; L-12081) Avail: NTIS HC A05/MF A01 CSCL 01C

A Au aircraft model with a close-coupled canard mounted above the wing chord plane was considered. Model angle of attack was varied from -4 deg to 15 deg; canard incidence was varied from -5 deg to 18 deg; and selected canard and wing flap deflections were investigated. By using the canard incidence for trim, maximum trimmed lift-drag ratios of about 8.8, 7.7, and 4.7 were obtained at free-stream Mach numbers of 0.40, 0.90, and 1.20, respectively. At a lift coefficient of 0.60, model trim angle of attack could be varied over an incremental range between 3.0 deg and 3.8 deg, depending on Mach number, by different combinations of control settings. At high lift coefficients, larger trimmed lift-drag ratios were obtained by using the deflection capability of the canard leading- and trailing-edge flaps before increasing canard incidence angle.
G. G.

N78-27137*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REAL TIME DIGITAL PROPULSION SYSTEM SIMULATION FOR MANNED FLIGHT SIMULATORS
James R. Mihaloew and Clint E. Hart 1978 45 p refs Presented at the 14th Propulsion Conf., Las Vegas, Nev., 25-27 Jul. 1978; sponsored by AIAA and the Soc. of Automotive Engr.
(NASA-TM-78958; E-9710) Avail: NTIS HC A03/MF A01 CSCL 01C

A real time digital simulation of a STOL propulsion system was developed which generates significant dynamics and internal variables needed to evaluate system performance and aircraft interactions using manned flight simulators. The simulation ran at a real-to-execution time ratio of 8.8. The model was used in a piloted NASA flight simulator program to evaluate the simulation technique and the propulsion system digital control. The simulation is described and results shown. Limited results of the flight simulation program are also presented. Author

N78-27138*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF ERRORS ON DECOUPLED CONTROL SYSTEMS
Harold A. Hamer and Katherine G. Johnson Jul. 1978 86 p refs
(NASA-TP-1184; L-11959) Avail: NTIS HC A05/MF A01 CSCL 01C

Various error sources in a decoupled control system are considered in connection with longitudinal control on a simulated externally blown jet-flap STOL aircraft. The system employed the throttle, horizontal tail, and flaps to decouple the forward velocity, pitch angle, and flight-path angle. The errors considered were: (1) imperfect knowledge of airplane aerodynamic and control characteristics; (2) imperfect measurements of airplane state variables; (3) change in flight conditions, and (4) lag in the airplane controls and in engine response. The effects of the various errors on the decoupling process were generally minor. Significant coupling in flight-path angle was caused by control lag during speed-command maneuvers. However, this coupling could be eliminated by including the control lag in the design of the decoupled system. Other error sources affected primarily the commanded response quantity. G.G.

N78-27139# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
INVESTIGATION OF A DISCRETE C-STAR TRANSIENT RESPONSE CONTROLLER FOR THE YF-16 AT A SELECTED FLIGHT CONDITION M.S. Thesis
Paul D. Monico Dec. 1977 200 p refs
(AF Proj. 7071)
(AD-A053441; AFIT/GGC/EE/77-8) Avail: NTIS HC A09/MF A01 CSCL 01/3

The feasibility of a discrete digital flight controller for the YF-16 Lightweight Fighter Prototype aircraft at Mach .8 at sea level is investigated. The investigation is limited to the longitudinal pitch axis. A reduced state, short period mathematical model of the YF-16 is developed from available data. The open loop stability and response characteristics of the model are shown to be unacceptable, necessitating the use of closed loop compensation. The minimization of a discrete cost function is used to develop a recursive discrete control formula. The thesis discusses and incorporates the concept of a proposed C-Star handling qualities criterion in the determination of acceptable response. Digital computer simulation on a CDC 6600 computer for various sample rates using a zero order hold or first order hold control scheme, results in a stabilized system model whose output falls within the bounds of a defined C-Star envelope, and capable of performing the tracking task of following a 1-G climb pilot input command. Typical results in the form of plotted time history information are discussed. Also discussed are the effects on the system of variations in sample rate, and cost functional penalty parameters. Control weighting is shown to be inversely proportional to the natural frequency while the trajectory weighting determines the damping ratio. GRA

N78-27140# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
INTERAC: AN INTERACTIVE SOFTWARE PACKAGE FOR DIRECT DIGITAL CONTROL DESIGN M.S. Thesis
James A. Colgate Dec. 1977 125 p refs
(AD-A053446; AFIT/GGC/EE/77D-1) Avail: NTIS HC A06/MF A01 CSCL 12/1

The purpose of this investigation is to develop an interactive, user oriented software package for direct digital control system design. The batch mode program, FORTRAC, developed by Professor Brian Porter of the University of Salford, England, is the source of the computational algorithms used. This report details the input, output, and program sequence control software developed to produce an efficient, user oriented interactive package. The package is very forgiving of user errors and gives the user complete control over what data to input, what data will be output, and which parts of the program are executed. The package is quite useful in the design process for discrete-time time-optimal control systems, where many possible control parameter variations must be examined. Author (GRA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N78-27141*# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.

SELF STREAMLINING WIND TUNNEL: FURTHER LOW SPEED TESTING AND FINAL DESIGN STUDIES FOR THE TRANSONIC FACILITY Semiannual Progress Report, period ending Dec. 1977

S. W. D. Wolf Dec. 1977 37 p refs

(Grant NsG-7172)

(NASA-CR-157111) Avail: NTIS HC A03/MF A01 CSCL 14B

Work has continued with the low speed self streamlining wind tunnel (SSWT) using the NACA 0012-64 airfoil in an effort to explain the discrepancies between the NASA Langley low turbulence pressure tunnel (LTPT) and SSWT results obtained with the airfoil stalled. Conventional wind tunnel corrections were applied to straight wall SSWT airfoil data, to illustrate the inadequacy of standard correction techniques in circumstances of high blockage. Also one SSWT test was re-run at different air speeds to investigate the effects of such changes on airfoil data and wall contours. Mechanical design analyses for the transonic self streamlining wind tunnel (TSWT) were completed by the application of theoretical airfoil flow field data to the elastic beam and streamline analysis. The control system for the transonic facility is outlined. B.B.

N78-27142*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INVESTIGATION OF MEANS FOR PERTURBING THE FLOW FIELD IN A SUPERSONIC WIND TUNNEL

Gary L. Cole and Warren R. Hingst Jun. 1978 30 p refs

(NASA-TM-78954; E-9703) Avail: NTIS HC A03/MF A01 CSCL 14B

The development status of a device for generating atmospheric-type turbulences in supersonic inlet testing is summaried. Elaborated are desired aerodynamic and actuation capabilities of the device, and the techniques that were considered and their drawbacks. G.G.

N78-27143*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DESIGN OF AN AIR EJECTOR FOR BOUNDARY-LAYER BLEED OF AN ACOUSTICALLY TREATED TURBOFAN ENGINE INLET DURING GROUND TESTING

Edward G. Stakolich Jun. 1978 21 p refs

(NASA-TM-78917; E-9655) Avail: NTIS HC A02/MF A01 CSCL 14B

An air ejector was designed and built to remove the boundary-layer air from the inlet a turbofan engine during an acoustic ground test program. This report describes; (1) how the ejector was sized; (2) how the ejector performed; and (3) the performance of a scale model ejector built and tested to verify the design. With proper acoustic insulation, the ejector was effective in reducing boundary layer thickness in the inlet of the turbofan engine while obtaining the desired acoustic test conditions. Author

N78-27144# Federal Aviation Administration, Washington, D. C.

AIRPORT SURFACE DETECTION EQUIPMENT (ASDE-3) PROJECT PLAN

M. E. Perie Jan. 1978 48 p

(AD-A052362; FAA-RD-78-12) Avail: NTIS HC A03/MF A01 CSCL 01/5

A primary radar and display system used to provide the airport surface traffic situation to the air traffic controller are considered. An ASDE-3 engineering model is being procured for testing. The program for development, test, evaluation, maintenance, and configuration control of the ASDE-3 engineering model is described, and the responsibilities of each of the participating organizations are delineated. G.G.

N78-27145# Sandia Labs., Albuquerque, N. Mex.

COMPUTER-CONTROLLED VIDEO INSTRUMENTATION TECHNIQUE FOR WIND TUNNEL TESTING OF FULL-SCALE LIFTING PARACHUTES

Robert H. Croll and C. W. Peterson 1978 7 p refs Presented at AIAA Testing Conf., San Diego, Calif., 19 Apr. 1978

(Contract EY-76-C-04-0789)

(SAND-77-1773C; Conf-780419-2) Avail: NTIS HC A02/MF A01

Wind tunnel tests of parachutes require that aerodynamic data be obtained simultaneously on both the forebody and the parachute. In particular, it is necessary to correlate the relative motion between the parachute and forebody to the loads exerted by the parachute on the forebody as a function of time during dynamic tests, disreefing, and for the full-open canopy. A computerized video instrumentation technique was developed to provide the correlation during a fullscale wind tunnel test of a unique parachute configuration. The instrumentation consisted of a small, rugged TV camera, mounted on the forebody base, which tracked the positions of two lights attached to the inside of the parachute canopy. The positions of the lights were digitized by an on line minicomputer and converted to yaw, pitch, and roll angles relative to the forebody. ERA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

N78-27146*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

THE VOYAGE OF MARINER 10: MISSIONS TO VENUS AND MERCURY

James A. Dunne and Eric Burgess 1978 233 p refs Original contains color illustrations

(NASA-SP-424; LC-77-18956) Avail: NTIS MF A01; SOD HC $12.25 CSCL 22A

The historical details of the Mariner 10 mission are recorded. Provided is a selection of some of the images obtained by the spacecraft at both Venus and Mercury. The solar sailing method greatly reduced the spacecraft's gas usage thus permitting two returns to Mercury. These revisits provided additional pictures of the planet's south pole and confirmed the existence of Mercury's magnetic field. G.G.

N78-27147*# National Aeronautics and Space Administration, Washington, D. C.

APOLLO-SOYUZ PAMPHLET NO. 1: THE FLIGHT

Lou Williams Page and Thornton Page From Oct. 1977 64 p refs Original contains color illustrations 9 Vol.

(NASA-EP-133) Avail: NTIS MF A01; SOD HC set of 9 volumes CSCL 22A

The goals of the Apollo-Soyuz Test Project are described in this first in a series of nine pamphlets designed as a curriculum supplement for teachers, supervisors, curriculum specialists, and textbook writers as well as for the general public. Aspects of the space flight covered include descriptions of the astronaut-cosmonaut meeting and of the spacecraft and landing module; spacecraft launch; control, and rendezvous; crew work schedule; and telemetry. Experiments performed are listed in tables, and their major results are summarized. A.R.H.

N78-27148*# National Aeronautics and Space Administration, Washington, D. C.

APOLLO-SOYUZ PAMPHLET NO. 2: X-RAYS, GAMMA-RAYS

Lou Williams Page and Thornton Page From Oct. 1977 74 p refs 9 Vol.

(NASA-EP-134) Avail: NTIS MF A01; SOD HC set of 9 volumes CSCL 22A

The nature of high energy radiation and its penetration through earth's atmosphere is examined with emphasis on X-rays, gamma rays, and cosmic radiation and the instruments used in their detection. The history of radio astronomy and the capabilities of

the Uhuru satellite are summarized. The ASTP soft X-ray experiment (MA-048) designed to study the spectra in the range from 0.1 to 10 keV and survey the background over a large section of the sky is described, as well as the determination of SMC C-1 as an X-ray pulsar. The crystal activation experiment (MA-151) used to measure the radioactive isotopes created by cosmic rays in crystals used for gamma ray detectors is also discussed. A.R.H.

N78-27149*# National Aeronautics and Space Administration, Washington, D. C.
APOLLO-SOYUZ PAMPHLET NO. 3: SUN, STARS, IN BETWEEN
Lou Williams Page and Thornton Page From Oct. 1977 64 p refs 9 Vol.
(NASA-EP-135) Avail: NTIS MF A01; SOD HC set of 9 volumes CSCL 22A

The structure of the sun and its surface temperature and brightness are discussed as background for explaining the ASTP joint experiment to photograph the solar corona from Soyuz while the Apollo spacecraft created an artificial eclipse by blocking out the sun. Stellar spectra, stellar evolution, and the Milky Way galaxy are explored in relation to the MA-083 experiment to survey the sky for extreme ultraviolet sources and background radiation. Interstellar gas and the spectrum of helium are discussed in relation to the MA-088 experiment designed to detect interstellar helium entering the solar system and to measure its density and motion. A.R.H.

N78-27150*# National Aeronautics and Space Administration, Washington, D. C.
APOLLO-SOYUZ PAMPHLET NO. 4: GRAVITATIONAL FIELD
Lou Williams Page and Thornton Page From Oct. 1977 40 p 9 Vol.
(NASA-EP-136) Avail: NTIS MF A01; SOD HC set of 9 volumes CSCL 22A

Two Apollo Soyuz experiments designed to detect gravity anomalies from spacecraft motion are described. The geodynamics experiment (MA-128) measured large-scale gravity anomalies by detecting small accelerations of Apollo in the 222 km orbit, using Doppler tracking from the ATS-6 satellite. Experiment MA-089 measured 300 km anomalies on the earth's surface by detecting minute changes in the separation between Apollo and the docking module. Topics discussed in relation to these experiments include the Doppler effect, gravimeters, and the discovery of mascons on the moon. A.R.H.

N78-27151*# National Aeronautics and Space Administration, Washington, D. C.
APOLLO-SOYUZ PAMPHLET NO. 5: THE EARTH FROM ORBIT
Lou Williams Page and Thornton Page From Oct. 1977 67 p refs Original contains color illustrations 9 Vol.
(NASA-EP-137) Avail: NTIS MF A01; SOD HC set of 9 volumes CSCL 22A

Astronaut training in the recognition of various geological features from space is described as well as the cameras, lenses and film used in experiment MA-136 to measure their effectiveness in photographing earth structural features from orbit. Aerosols that affect climate and weather are discussed in relation to experiment Ma-007 which relied on infrared observations of the setting or rising sun, as seen from Apollo, to measure the amount of dust and droplets in the lower 150 km of earth's atmosphere. The line spectra of atomic oxygen and nitrogen and their densities at 22 km above the earth's surface are examined along with experiment MA-059 which measured ultraviolet absorption at that altitude. A.R.H.

N78-27152*# National Aeronautics and Space Administration, Washington, D. C.
APOLLO-SOYUZ PAMPHLET NO. 6: COSMIC RAY DOSAGE
Lou Williams Page and Thornton Page From Oct. 1977 46 p 9 Vol.
(NASA-EP-138) Avail: NTIS MF A01; SOD HC set of 9 volumes CSCL 22A

The radiation hazard inside spacecraft is discussed with emphasis on its effects on the crew, biological specimens, and spacecraft instruments. The problem of light flash sensations in the eyes of astronauts is addressed and experiment MA-106 is described. In this experiment, light flashes seen by blindfolded astronauts were counted and high energy cosmic ray intensity in the command module cabin were measured. The damage caused by cosmic ray hits on small living organisms was investigated in the Biostack 3 experiment (MA-107). Individual cosmic rays were tracked through layers of bacterial spores, small seeds, and eggs interleaved with layers of AgCl-crystal wafers, special plastic, and special photographic film that registered each cosmic ray particle passed. A.R.H.

N78-27153*# National Aeronautics and Space Administration, Washington, D. C.
APOLLO-SOYUZ PAMPHLET NO. 8: ZERO-G TECHNOLOGY
Lou Williams Page and Thornton Page From Oct. 1977 68 p refs Original contains color illustrations 9 Vol.
(NASA-EP-140) Avail: NTIS MF A01; SOD HC set of 9 volumes CSCL 22A

The behavior of liquids in zero gravity environments is discussed with emphasis on foams, wetting, and wicks. A multipurpose electric furnace (MA-010) for the high temperature processing of metals and salts in zero-g is described. Experiments discussed include: monotectic and synthetic alloys (MA-041); multiple material melting point (MA-150); zero-g processing of metals (MA-070); surface tension induced convection (MA-041); halide eutectic growth; interface markings in crystals (MA-060); crystal growth from the vapor phase (MA-085); and photography of crystal growth (MA-028). A.R.H.

N78-27154*# National Aeronautics and Space Administration, Washington, D. C.
APOLLO-SOYUZ PAMPHLET NO. 9: GENERAL SCIENCE
Lou Williams Page and Thornton Page From Oct. 1977 88 p refs Original contains color illustrations 9 Vol.
(NASA-EP-141) Avail: NTIS MF A01; SOD HC set of 9 volumes CSCL 22A

The objectives and planning activities for the Apollo-Soyuz mission are summarized. Aspects of the space flight considered include the docking module and launch configurations, spacecraft orbits, and weightlessness. The 28 NASA experiments conducted onboard the spacecraft are summarized. The contributions of the mission to the fields of astronomy, geoscience, biology, and materials sciences resulting from the experiments are explored. A.R.H.

N78-28041# Joint Publications Research Service, Arlington, Va.
FEOKTISTOV INTERVIEWED ON FUTURE OF SOVIET COSMONAUTS
K. P. Feoktistov and S. Vlasov *In its* Transl. on USSR Sci. and Technol. (JPRS-71393) 30 Jun. 1978 p 50-55 Transl. into ENGLISH from Ogonyek (Moscow), no. 15, Apr. 1978 p 14-16 (For primary document see N78-28033 18-99)
Copyright. Avail: NTIS HC A02/MF A01

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N78-27155 Colorado Univ. at Boulder.
SATELLITE ORBITS UNDER THE INFLUENCE OF AIR DRAG, ROTATING OBLATE ATMOSPHERE, AND PLANET'S OBLATENESS Ph.D. Thesis
Wu-Torng Chen 1977 123 p
Avail: Univ. Microfilms Order No. 7808883

The equations of motion of a close satellite moving in a realistic planetary atmosphere are provided. The decay or variation of the elements of a satellite's orbit is evaluated analytically and numerically. By solving the simultaneous nonlinear differential equations numerically and by applying the method of averaging and Poincare's method of small parameters for the integration and then by using Lagrange expansion to get the explicit formulas

for the variations of the orbital elements. Results show that atmospheric drag is the most important factor in the decay of a close satellite's orbit. The significance of the effects of oblate, rotating atmosphere and planet's oblateness depends upon the argument of initial periapsis, the initial inclination, and the initial eccentricity of the satellite's orbit. Dissert. Abstr.

N78-27156*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
INTERPLANETARY APPROACH OPTICAL NAVIGATION WITH APPLICATIONS
Navin Jerath 1 Jun. 1978 271 p refs
(Contract NAS7-100)
(NASA-CR-157291; JPL-Pub-78-40) Avail: NTIS HC A12/MF A01 CSCL 22A

The use of optical data from onboard television cameras for the navigation of interplanetary spacecraft during the planet approach phase is investigated. Three optical data types were studied: the planet limb with auxiliary celestial references, the satellite-star, and the planet-star two-camera methods. Analysis and modelling issues related to the nature and information content of the optical methods were examined. Dynamic and measurement system modelling, data sequence design, measurement extraction, model estimation and orbit determination, as relating optical navigation, are discussed, and the various error sources were analyzed. The methodology developed was applied to the Mariner 9 and the Viking Mars missions. Navigation accuracies were evaluated at the control and knowledge points, with particular emphasis devoted to the combined use of radio and optical data. A parametric probability analysis technique was developed to evaluate navigation performance as a function of system reliabilities. G.G.

N78-27157*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ENTRY FLIGHT CONTROL SYSTEM DOWNMODING EVALUATION Final Report
H. A. Barnes 24 Feb. 1978 67 p refs
(NASA-TM-79513) Avail: NTIS HC A04/MF A01 CSCL 22A

A method to desensitize the entry flight control system to structural vibration feedback which might induce an oscillatory instability is described. Trends in vehicle response and handling characteristics as a function of gain combinations in the FCS forward and rate feedback loops were described as observed in a man-in-the-loop simulation. Among the flight conditions considered are the effects of downmoding with APU failures, off-nominal trajectory conditions, sensed angle of attack errors, the impact on RCS fuel consumption, performance in the presence of aero variations, recovery from large FCS upsets, and default gains. Author

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

N78-27158*# National Aeronautics and Space Administration, Washington, D. C.
BAYKONUR
B. P. Vladimirov Jun. 1978 16 p Transl. into ENGLISH from Zemlya Vselennaya (USSR), no. 1, Jan. - Feb. 1978 p 64-71 Original language document was announced as N78-24033 Transl. by Sci. Transl. Serv., Santa Barbara, Calif.
(Contract NASw-2791)
(NASA-TM-75109) Copyright. Avail: NTIS HC A02/MF A01 CSCL 22D

The 'Baykonur' cosmodrome, its functions, operations, and serives are described in considerable detail. The launch complex, launching pads, launch structures, launchers with cable masts and propellant loading towers, are included. The sequence of all phases of rocket assembly and preparations for launch are depicted. Prelaunch procedures and the launch itself are described. J.M.S.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N78-27159*# Aerospace Corp., Los Angeles, Calif. Space Sciences Lab.
DATA ANALYSIS OF THE LPSP EXPERIMENT ON OSO-8 Final Report
E. N. Frazier 1 Jun. 1978 15 p ref
(Contract NASw-3067)
(NASA-CR-157706; ATR-78(9461)-4) Avail: NTIS HC A02/MF A01 CSCL 05B

The first and statistically most reliable step in the data analysis - the computation of the vertical phase lag between photospheric and chromospheric oscillations - was completed. Unfortunately, the error associated with this calculated phase lag is so great that the result has no physical significance. Since the subsequent data analysis that was originally planned would have much larger associated errors, it was concluded that the data available is insufficient to allow any meaningful results to be derived. Accordingly, the project was terminated. The reasons for the failure of the data are discussed. There are two basic reasons for this failure; (1) the very low signal to noise ratio of the raw data, and (2) the small statistical sample that resulted from the very small number of usable orbits. The final phase of data analysis is described. Finally, some comments and recommendations of a general nature are made concerning this entire contract effort. It is hoped that at least some lessons can be learned from this particular Guest Investigator project, so that future Guest Investigator programs can be pursued more effectively, and with less risk. G.Y.

N78-27160# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PACKET SWITCHING IN A PROCESSING SATELLITE
Joseph K. DeRosa and Lawrence H. Ozarow 3 Aug. 1977 4 p refs Repr. from Proc. of the IEEE, v. 66, no. 1, Jan. 1978
(Contract F19628-76-C-0002)
(AD-A053902; JA-4774; ESD-TR-78-44) Avail: NTIS HC A02/MF A01 CSCL 17/2

This brief note represents a simple but significant change in the thinking that is applied to satellite packet switching. It demonstrates that in a processing satellite there is no fundamental limitation to the efficiency and throughput of packet switching systems. With a minimal impact on spacecraft weight and power, throughput is increased by providing more capacity on the uplink than on the downlink. Efficiency is increased because the power-intensive downlink is more fully utilized. A slotted ALOHA example is given to show how the performance can be made to go from that of conventional slotted ALOHA to that of a TDM system. Several possible variations and far-reaching implications are indicated. Author (GRA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N78-27161*# Boeing Aerospace Co., Seattle, Wash.
TECHNOLOGY REQUIREMENTS FOR ADVANCED EARTH ORBITAL TRANSPORTATION SYSTEMS. VOLUME 3: SUMMARY REPORT - DUAL MODE PROPULSION
A. K. Hepler and E. L. Bangsund Jul. 1978 93 p refs
(Contract NAS1-13944)
(NASA-CR-3037; D180-19168-5) Avail: NTIS HC A05/MF A01 CSCL 22A

The impact of dual-mode propulsion on cost-effective technology requirements for advanced earth-orbital transportation systems is considered. Additional objectives were to determine the advantages of the best dual mode concept relative to the LO2/LH2 concept of the basic study. Normal technology requirements applicable to horizontal take-off and landing single-stage-to-orbit systems utilizing dual mode rocket propulsion were projected to the 1985 time period. These technology projections were then incorporated in a vehicle parametric design analysis for two different operational concepts of a dual mode propulsion system. The resultant performance, weights and costs of each concept were compared. The selected propulsion concept was evaluated to confirm the parametric trending/scaling of weights and to optimize the configuration. G.G.

N78-27162*# LinCom Corp., Pasadena, Calif.
SHUTTLE KU-BAND SIGNAL DESIGN STUDY Final Report
William C. Lindsey, Walter R. Braun, and Terrie M. McKenzie 15 May 1978 217 p refs
(Contract NAS9-14846)
(NASA-CR-151743; TR-7805-0476) Avail: NTIS HC A10/MF A01 CSCL 22B

Carrier synchronization and data demodulation of Unbalanced Quadriphase Shift Keyed (UQPSK) Shuttle communications' signals by optimum and suboptimum methods are discussed. The problem of analyzing carrier reconstruction techniques for unbalanced QPSK signal formats is addressed. An evaluation of the demodulation approach of the Ku-Band Shuttle return link for UQPSK when the I-Q channel power ratio is large is carried out. The effects that Shuttle rocket motor plumes have on the RF communications are determined also. The effect of data asymmetry on bit error probability is discussed. L.S.

N78-27163*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE SHUTTLE ASTRODYNAMICAL CONSTANTS
B. F. Cockrell and Bruce Williamson Jun. 1978 17 p refs
(NASA-TM-79516; JSC-14262; Rept-78-FM-32; MSC-02446) Avail: NTIS HC A02/MF A01 CSCL 03B

Basic space shuttle astrodynamic constants are reported for use in mission planning and construction of ground and onboard software input loads. The data included here are provided to facilitate the use of consistent numerical values throughout the project. G.G.

N78-27164*# IBM Federal Systems Div., Houston, Texas.
SPACE SHUTTLE ORBITER AVIONICS SOFTWARE: POST REVIEW REPORT FOR THE ENTRY FACI (FIRST ARTICLE CONFIGURATION INSPECTION)
H. Markos 9 May 1978 152 p
(Contract NAS9-14444)
(NASA-CR-151742; IBM-78-SS-3937) Avail: NTIS HC A08/MF A01 CSCL 22B

Status of the computer programs dealing with space shuttle orbiter avionics is reported. Specific topics covered include: delivery status; SSW software; SM software; DL software; GNC software; level 3/4 testing; level 5 testing; performance analysis, SDL readiness for entry first article configuration inspection; and verification assessment. J.M.S.

N78-27165*# Texas Univ. at Austin. Dept. of Aerospace Engineering and Engineering Mechanics.
THE EFFECT OF THE TRANSPORT PROPERTY MODELS ON THE SHUTTLE BOUNDARY LAYER
John J. Bertin, Daniel R. Neal, and Dennis D. Stalmach Jun. 1978 111 p refs
(Contract NAS9-13680)
(NASA-CR-151748; Rept-78002) Avail: NTIS HC A06/MF A01 CSCL 22B

Theoretical solutions for the nonsimilar, laminar boundary-layer were computed for four points along the shuttle entry trajectory. Since the boundary layer is that region of the flow field where the effects of viscosity and of thermal conductivity are most important, numerical solutions for the boundary layer were generated using different models for the transport properties. These solutions indicate that the displacement thickness and the heat-transfer rates are very sensitive to changes in the models for thermal conductivity and for specific heat. Thus, the solutions are sensitive to the assumed transport-property model. G.G.

N78-27166*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE 1980-90 SHUTTLE STAR CATALOG FOR ONBOARD AND GROUND PROGRAMS
Sandy Richardson and Rosemary Killen (McDonnell-Douglas Tech. Serv. Co., Inc.) Jun. 1978 79 p refs
(NASA-TM-79514; JSC-14292; Rept-78-FM-38) Avail: NTIS HC A05/MF A01 CSCL 22A

The 1980-90 shuttle star catalog for onboard and ground programs is presented. The data used in this catalog are explained according to derivation, input, format for the catalog, and preparation. The tables include the computer program listing, input star position, and the computed star positions for the years 1980-90. J.M.S.

N78-27167*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ORBIT IMU ALINEMENT INTERPRETATION OF ONBOARD DISPLAY DATA
Roger Corson (McDonnell-Douglas Tech. Serv. Co., Inc.) Jun. 1978 20 p refs
(NASA-TM-79515; JSC-14270; Rept-78-FM-34) Avail: NTIS HC A02/MF A01 CSCL 22B

The space shuttle inertial measurement unit (IMU) alinement algorith was examined to determine the most important alinement starpair selection criterion. Three crew displayed parameters were considered: (1) the results of the separation angle difference (SAD) check for each starpair; (2) the separation angle of each starpair; and (3) the age of each star measurement. It was determined that the SAD for each pair cannot be used to predict the IMu alinement accuracy. If the age of each star measurement is less than approximately 30 minutes, time is a relatively unimportant factor and the most important alinement pair selection criterion is the starpair separation angle. Therefore, when there are three available alinement starpairs and all measurements were taken within the last 30 minutes, the pair with the separation angle closest to 90 degrees should be selected for IMU alinement. J M.S.

N78-27168*# Boeing Aerospace Co., Seattle, Wash. Space Systems Div.
TECHNOLOGY REQUIREMENTS FOR ADVANCED EARTH ORBITAL TRANSPORTATION SYSTEM. VOLUME 1: EXECUTIVE SUMMARY Final Report
A. K. Hepler and E. L. Bangsund Jul. 1978 43 p
(Contract NAS1-13944)
(NASA-CR-2878; D180-19168-3-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 22A

Normal technology requirements applicable to Single Stage to Orbit (SSTO) systems were projected to the 1985 time period. These technology projections were then incorporated in a vehicle design analysis of three different operational concepts resulting in four configurations of a Single Stage to Orbit system. The resultant performance, weights and costs of each concept were then compared and a system concept selected. A figure of merit was developed for advanced technology programs based on a cost/performance basis. The selected advanced technology programs were then used to reassess the vehicle to determine the impact on performce, weight and cost. Based on study results, recommendations are provided in technology areas associated with earth orbit transportation systems. The recommendations address advanced space transportation system design considerations, both hardware and software technolgoy program requirements. B.B.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N78-27169# Toronto Univ. (Ontario). Inst. for Aerospace Studies.

DYNAMICS OF SPINNING SPACECRAFT WITH TUBULAR APPENDAGES INCLUDING LARGE AMPLITUDE DEFLECTIONS

P. K. Nguyen Feb. 1978 155 p refs
(UTIAS-223; CN-ISSN-0082-5255) Avail: NTIS HC A08/MF A01

The flexible spinning spacecraft under consideration is of the Alouette type. It consists of a relatively rigid center body to which are appended one or more pairs of diametrically opposed, long, slender booms, all lying in the same plane. Both constrained and inconstrained vibrational frequencies of the spacecraft are investigated in detail. A Galerkin solution is presented for boom bending with large amplitudes and nonlinear inertial accelerations taken into account. Due to the high nonlinearity of the equations, only in-plane bending is considered. Using a one-mode approximation, the solution is presented in terms of the phase plane and the variation of nonlinear frequencies with amplitudes. The boom response to solar radiation is also studied. A Kelvin-Voigt model is used to represent material damping The boom response is found to depend on three important dimensionless parameters which are functions of heat intensity, boom length, thermal time constant, spin rate and material damping. Author

N78-27170*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

STATUS OF THE NASA-LEWIS RESEARCH CENTER SPACECRAFT CHARGING INVESTIGATION

N. John Stevens, Frank D. Berkopec, and Carolyn K. Purvis 1978 25 p refs Presented at the Spacecraft Electromagnetic Compatibility Seminar, Noordwijk, The Netherlands, 24-26 May 1978; sponsored by the European Space Research and Technology Centre (ESTEC)
(NASA-TM-78938; E-9682) Avail: NTIS HC A02/MF A01 CSCL 22B

The technology necessary to control the absolute and differental charging of spacecraft surfaces is detailed for developing ground simulation facilities, characterizing the charging and discharging characteristics of spacecraft materials, deriving analytical modelling tools and issuing design guideline documents. Facilities were developed and testing of various materials was completed. Comparisons between experimental results, space results and predictions from models were made. Harness transient monitors were flown on satellites. G.G.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N78-27171# Rocket Propulsion Establishment, Westcott (England).

TWO-DIMENSIONAL, TWO-PHASE FLOW THROUGH A ROCKET EXHAUST NOZZLE Progress Report

Jane M. Cousins Aug. 1976 34 p refs
(RPE-Memo-685; BR55710) Avail: NTIS HC A03/MF A01

The development of a set of computer programs which solve the equations of gas/particle flow through an axisymmetric nozzle is considered. Two programs were written to solve the equations in the transonic throat region of the nozzle. The first treats two-phase fluid as a heavy perfect gas with modified isentropic exponent and molecular weight, and solves the equations of isentropic transonic flow. An initial flow field configuration was obtained for input to the second program, which incorporates non-equilibrium effects of the gas/particle mixture. The programs privide accurate initial line data for starting a supersonic calculation. Author

N78-27172*# TRW Defense and Space Systems Group, Redondo Beach, Calif.

PARTICLE IMPACT TESTS Final Report

G. K. Komatsu May 1978 31 p refs
(Contract NAS9-15443)
(NASA-CR-151739; TRW-32970-6001-RU-00) Avail: NTIS HC A03/MF A01 CSCL 21H

Particle impact tests were performed on three types of orbiter surface with a micrometeoroid facility. The test equipment electrostatically accelerated micron sized particles to high velocities simulating micrometeoroid impacts. Test particles were titanium diboride with typical velocities in the range 1 to 2.3 km x sec/1 and equivalent particle diameters in the range 4 to 16 microns. Impact angles to the material surface were 90, 60 and 30 degrees. The particle impact sites were located on the sample surfaces and craters were photographed with a magnification of 400X. G.G.

N78-27173*# TRW Defense and Space Systems Group, Houston, Tex. Systems Engineering and Analysis Dept.

EQUATIONS FOR CALCULATING ORBITER SURFACE EROSION AND BREAKAGE RATES IN IUS AND SSUS SRM EXHAUST PLUMES

S. W. Wilson 6 Jun. 1978 35 p refs
(Contract NAS9-14723)
(NASA-CR-151736; TRW-28415-H007-RO-00) Avail: NTIS HC A03/MF A01 CSCL 21H

Equations and coefficients for calculating the flux of solid particles in the exhaust plumes of the interim upper stage and SSUS solid rocket motors (SRM) are considered. Modifications required to account for the independent motions of the orbiter and the SRM, such as will result during an on-orbit SRM firing are described. J.M.S.

N78-27174*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PERFORMANCE OF A THERMIONIC CONVERTER MODULE

UTILIZING EMITTER AND COLLECTOR HEAT PIPES
Erich Kroeger, James Morris, Gabor Miskolczy (Thermo Electron Corp.), David P. Lieb (Thermo Electron Corp.), and Douglass B. Goodale (Thermo Electron Corp.) Jun. 1978 38 p refs
(Contract NAS3-20270)
(NASA-TM-78941; E-9705) Avail: NTIS HC A03/MF A01 CSCL 10A

A thermionic converter module simulating a configuration for an out-of-core thermionic nuclear reactor was designed, fabricated, and tested. The module consists of three cylindrical thermionic converters. The tungsten emitter of the converter is heated by a tungsten, lithium heat pipe. The emitter heat pipes are immersed in a furnace, insulated by MULTI-FOIL thermal insulation, and heated by tungsten radiation filaments. The performance of each thermionic converter was characterized before assembly into the module. Dynamic voltage, current curves were taken using a 60 Hz sweep and computerized data acquisition over a range of emitter, collector, and cesium-reservoir temperatures. An output power of 215 W was observed at an emitter temperature of 1750 K and a collector temperature of 855 K for a two diode module. With a three diode module, an output power of 270 W was observed at an average emitter temperature of 1800 K and a Collector temperature of 875 K. J.M.S.

N78-27175*# National Aeronautics and Space Administration, Washington, D. C.
ROCKETS, THEIR CONSTRUCTION AND USE
G. E. Langemak and V. P. Glushko Jul. 1978 186 p refs Transl. into ENGLISH of the book "Raketen, ihre Konstruktion und Verwendyng" Supreme Command of the Navy, Res. Develop. and Patents Branch, Germany, 1940? 162 p (Originally published in RUSSIAN by Dept. of Sci. and Tech. Inform., People's Commissariat of Heavy Ind. and the Main Editorial Office for Aeronaut. Lit., Moscow-Leningrad, 1935 Sponsored by NASA Transl. by Agencie Tunitsienne de Public Relations
(Contract NSF C-504)
(NASA-TM-75021) Avail: NTIS A09/MF A01 CSCL 21H

Reactive motion and the fundamental principles of rocket flight are discussed. The most important technical problems associated with the realization and utilization of solid and liquid fueled rockets are elucidated and possible applications of each are examined. Characteristic rocket designs described in general literature and in foreign patent specifications are systematically explored and critically analyzed. A.R.H.

N78-27176*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PASSIVE PROPELLANT SYSTEM Patent Application
Donald A. Hess (McDonnell Douglas Astronautics Co., St. Louis, Mo.), William W. Regnier (McDonnell Douglas Astronautics, Mo.), and Virgil L. Jacobs, inventors (to NASA) Filed 11 Jul. 1978 16 p Sponsored by NASA
(NASA-Case-MFS-23642-2; US-Patent-Appl-SN-923758) Avail: NTIS HC A02/MF A01 CSCL 20H

The system utilizes a spherical tank structure A separated into two equal volume compartments by a flat bulkhead B. Each compartment has four similar gallery channel legs located in the principal vehicle axes, ensuring that bulk propellant will contact at least one gallery leg during vehicle maneuvers. The forward compartment gallery channel legs collect propellant and feed it into the aft compartment through communication screens which protrude into the aft compartment. The propellant is then collected by the screened gallery channels in the aft compartment and supplied to the propellant outlet. The invention resides in the independent gallery assembly and screen structure by means of which propellant flow from forward to aft compartments is maintained. Liquid surface tension of the liquid on the screens is used to control liquid flow. The system provides gas-free propellants in low or zero-g environments regardless of axial accelerations and propellant orientation in bulk regions of the vessel. NASA

N78-27177# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
EVALUATION OF THE PILOT ROCKET SCRUBBER Final Report, 1970 - 1977
Luciano Sedillo Jan. 1978 39 p refs
(AD-A053792; AFRPL-TR-77-89) Avail: NTIS HC A03/MF A01 CSCL 21/2

The technical and economical feasibility of a pilot rocket scrubber was evaluated based on 23 tests of liquid and solid rocket motors with a thrust of 5,000 pounds. The initial test, using liquid fluorine and gaseous hydrogen, resulted in extensive damage to the test system. After switching to storable liquid propellants, 18 tests were conducted to characterize the scrubber system. The main concern of the Air Force was the results from scrubbing four solid rocket motors. This report summarizes the history, and describes the installation, testing, evaluation, and costs for operating the pilot rocket scrubber. GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N78-27178# Army Medical Bioengineering Research and Development Lab., Fort Detrick, Md.
MECHANISM OF THE REACTION OF BROMINE AND POLYHYDRIC PHENOLS TO FORM BROMINATED METHANE COMPOUNDS: BROMINATION OF DIMEDONE
William F. Cowen, David H. Rosenblatt, and Clarence W. R. Wade Apr. 1978 32 p refs
(DA Proj. 3A1-61101-A-91C)
(AD-A053768; USAMBRDL-TR-7806) Avail: NTIS HC A03/MF A01 CSCL 07/3

This research project was established to investigate the mechanisms by which aqueous bromine solutions react with polyhydric phenols to form brominated methane compounds. An analytical procedure was successfully established, based on procedures developed at the U.S. Environmental Protection Agency, to determine the methane compounds. In spite of the increasing work load from other projects, a few significant preliminary experiments were performed before this project had to be terminated. This report is a summary of the significant literature accumulated for the research protocol, the detailed methodology employed in conducting the bromination test and gas chromatographic analyses, and the results of reactions between bromine and dimedone and between dibromodimedone and water. GRA

N78-27179# Cornell Univ., Ithaca, N. Y.
ANAEROBIC FERMENTATION OF AGRICULTURAL RESIDUE: POTENTIAL FOR IMPROVEMENT AND IMPLEMENTATION Final Report
W. J. Jewell, H. R. Capener, and S. Dellorto Feb. 1978 456 p refs
(Contract EY-76-S-02-2981)
(HCP/T2981-07) Avail: NTIS HC A20/MF A01

The results of studies designed to evaluate the potential of rapidly improving the technology of anaerobic fermentation of agricultural residues and methods of implementing it in existing agricultural operations are reported. The main objectives of this study were to: identify simple and low cost anaerobic fermentor design criteria that would be appropriate in small agricultural operations, develop high rate fermentor concepts that would enable multiple product recovery from the reactor, expand the information base particularly in the area of temperature influence on the process, and to review sociological and economic issues relating to implementation of fermentation technology. ERA

24 COMPOSITE MATERIALS

Includes laminates.

N78-27180* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INTUMESCENT-ABLATOR COATINGS USING ENDOTHERMIC FILLERS Patent
Paul M. Sawko and Salvatore R. Riccitiello, inventors (to NASA) Issued 9 May 1978 11 p Filed 23 Dec. 1976 Supersedes N77-14372 (15 - 05, p 0609)

(NASA-Case-ARC-11043-1; US-Patent-4,088,806; US-Patent-Appl-SN-753964; US-Patent-Class-428-332; US-Patent-Class-260-33.6EP; US-Patent-Class-260-33.6PQ; US-Patent-Class-260-33.8EP; US-Patent-Class-260-33.8UA; US-Patent-Class-260-37EP; US-Patent-Class-260-42.43; US-Patent-Class-260-45.7R; US-Patent-Class-260-45.75W; US-Patent-Class-260-45.85N; US-Patent-Class-260-45.9R; US-Patent-Class-427-386; US-Patent-Class-427-388A; US-Patent-Class-428-313; US-Patent-Class-428-921) Avail: US Patent Office CSCL 11D

An intumescent-ablator coating composition which contains the ammonium salt of 1,4-nitroaniline-2-sulfonic acid or 4,4 dinitrosul fanilide, a polymeric binder system and about 5 to 30% weight of an endothermic filler is reported. The filler has a decomposition temperature about or within the exothermic region of the intumescent agent.

Official Gazette of the U.S. Patent Office

N78-27181 Texas Univ. at Austin.

AN INVESTIGATION OF THE TRIBOLOGICAL PROPERTIES OF GRAPHITE FIBER-METAL MATRIX COMPOSITES Ph.D. Thesis

Cecil Hugh Ramage 14 Jul. 1978 192 p

Avail: Univ. Microfilms Order No. 7807369

Several types of oriented graphite fibers, prepared from three types of precursors and various combinations of matrix material (mainly copper-tin bronzes with different tin content) were evaluated. The tests were conducted using two counterfaces; one made from steel, the other from aluminum with a flame-sprayed copper surface. Friction coefficient and wear rate depended on sliding velocity, fiber orientation, matrix composition (tin content), type of fiber, manufacturing parameters, counterface material, and test environment. If a high density electrical current was passed through the brush-rotor interface, the friction coefficient and the wear rate were in general, higher than similar results without current, and are practically independent of matrix tin content. As frictional heating increased, friction coefficient decreased, while wear rate and voltage drop across the interface both increased. Dissert. Abstr.

N78-27182*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

METHOD OF MANUFACTURE OF BONDED FIBER FLYWHEEL Patent Application

George M. Weyler, Jr., inventor (to NASA) Filed 5 Jun. 1978 13 p

(NASA-Case-MFS-23674-1; US-Patent-Appl-SN-912276) Avail: NTIS HC A02/MF A01 CSCL 11D

The novelty of this invention is that of effecting curing of the epoxy which bonds the fibers together while the fibers are in a stressed state. It appears that by doing this, a flywheel can be constructed which is capable of being operated at higher rotational speeds, enabling a greater storage of energy for a given weight of flywheel. NASA

N78-27183*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

COMPOSITE STRUCTURES FOR COMMERCIAL TRANSPORT AIRCRAFT

Louis F. Vosteen Jun. 1978 25 p refs

(NASA-TM-78730) Avail: NTIS HC A02/MF A01 CSCL 11D

The development of graphite-epoxy composite structures for use on commercial transport aircraft is considered. Six components, three secondary structures, and three primary structures, are presently under development. The six components are described along with some of the key features of the composite designs and their projected weight savings. G.G.

N78-27184*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

LOW DENSITY BISMALEIMIDE-CARBON MICROBALLOON COMPOSITES Patent Application

Demetrius A. Kourtides and John A. Parker, inventors (to NASA) Filed 30 Jun. 1978 25 p

(NASA-Case-ARC-11040-2; US-Patent-Appl-SN-920878) Avail: NTIS HC A02/MF A01 CSCL 11D

A process is described for constructing for a composite laminate structure which exhibits a high resistance to heat and flame provides safer interior structures for aircraft and submarine compartments. Composite laminate structures are prepared by the bismaleimide resin preimpregnation of a fiberglass cloth to form a face sheet which is bonded with a bismaleimide hot melt adhesive to a porous core structure selected from the group consisting of polyamide paper and bismaleimide-glass fabric which is filled with carbon microballoons. The carbon microballoons are prepared by pyrolyzing phenolic micro-balloons in the presence of nitrogen. A slurry of the carbon microballoons is prepared to fill the porous core structure. The porous core structure and face sheet are bonded to provide panel structures exhibiting increased mechanical capacities and lower oxygen limit values and smoke density values. NASA

N78-27185*# National Aeronautics and Space Administration, Washington, D. C.

THE PROSPECTS FOR COMPOSITES BASED ON BORON FIBERS

R. Naslain Jun. 1978 24 p refs Transl. into ENGLISH from Aeronaut. Astronaut. (Paris), no. 65, 1977 p 25-36 Original language document was announced as A78-12033 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Lab. of Solid-State Chem., Natl Center of Sci.-Res., Talence, Ironde, France

(Contract NASw-2790)

(NASA-TM-75305) Avail: NTIS HC A02/MF A01 CSCL 11D

The fabrication of boron filaments and the production of composite materials consisting of boron filaments and organic or metallic matrices are discussed. Problem involving the use of tungsten substrates in the filament fabrication process, the protection of boron fibers with diffusion barier cladings, and the application of aloy additives in the matrix to lessen the effects of diffusion are considered. Data on the kinetics of the boron fiber/matrix interaction at high temperatures, and the influence of the fiber/matrix interaction on the mechanical properties of the composite are presented. Author

N78-27186# Sandia Labs., Albuquerque, N. Mex.

HPBN DEVELOPMENT

J. L. Irwin 1978 22 p refs Presented at Advances in Reentry Thermal Protection Technol., Los Angeles, 15 Feb. 1978

(Contract EY-76-C-04-0789)

(SAND-782076C; Conf-780220-1) Avail: NTIS HC A02/MF A01

The physcial and mechanical properties of hot pressed boron nitride (HPBN) are given. Types of HPBN studied include: HD 0092 (HBC), TS1251, and modified HPBN (SS3500, SS3900). Ultrasonic modulus, average ultimate tensile strength, and compressive strength are shown in relation to temperature for TS1251 and SS3500. Other properties depicted include: stress-strain relationships, thermal expansion, thermal conductivity, and average dielectric properties. Ablation test data, material models, and typical flight thermal stress comparison are also given. It is concluded that materials with limited metallic inclusions are preferred in order to improve properties affecting thermal stresses. ERA

N78-27187# General Atomic Co., San Diego, Calif.

EFFECT OF STEAM OXIDATION ON STRENGTH, ELASTIC MODULUS, AND STRAIN AT FRACTURE OF GRAPHITE 2020

C. Velasquez, G. Hightower, and R. Burnette Dec. 1977 78 p refs

(Contract EY-76-C-03-0167-017)

(GA-A-14651) Avail: NTIS HC A05/MF A01

Stackpole Carbon's graphite grade 2020, a candidate material for support posts in GA HTGRs, was oxidized in steam-helium mixtures to 25 wt % burnoff. The effects of the oxidation on ultimate strength, elastic modulus, and strain at fracture are reported. A large number of nonoxidized and oxidized tensile specimens were tested to failure. Average losses of 6.7 wt % in strength and 7.4 wt % in elastic modulus at 1% burnoff were obtained. No significant change in strain at fracture was observed for burnoffs up to 5%. The elastic modulus and ultimate tensile strength of the oxidized samples correlated with bulk density. ERA

N78-27188# California Univ., Livermore. Lawrence Livermore Lab.
BIBLIOGRAPHIC AND NUMERIC DATA BASES FOR FIBER COMPOSITES AND MATRIX MATERIALS
F. E. McMurphy and T. M. Quick 11 Jan. 1978 12 p refs Presented at 2d Conf. on Composite Material, Toronto, 16 Apr. 1978
(Contract W-7405-eng-48)
(UCRL-79503-Rev-1; Conf-780414-1) Avail: NTIS HC A02/MF A01

Research leading to the creation of bibliographic and numeric data bases of material properties with particular emphasis to their application to modern flywheel technology is reported. The bibliographic data base was created to provide a direct means to visually examine pertinent literature. The numeric data base is being created to provide evaluated materials properties data for direct input to applications programs. Data bases and their evaluation programs will be stored on a PDP 11/70 computer system. ERA

N78-27189# National Technical Information Service, Springfield, Va.
BORON REINFORCED COMPOSITES, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Apr. 1978
Diane M. Cavagnaro Apr. 1978 202 p Supersedes NTIS/PS-77/0364, NTIS/PS-76/0420, NTIS/PS-75/414 and COM-74-10854
(NTIS/PS-78/0357/0; NTIS/PS-77/0364; NTIS/PS-76/0420; NTIS/PS-75/414; COM-74-10854) Avail: NTIS HC $28.00/MF $28.00 CSCL 11D

The bibliography cites Federally-funded research on boron fibers and boron compounds used as reinforcing material in composites. Included are studies on fabrication, testing, uses, and structural and mechanical properties. (This updated bibliography contains 197 abstracts, 54 of which are new entries to the previous edition). GRA

N78-27060*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INTRODUCTION TO SESSION ON MATERIALS AND STRUCTURES
Louis F. Vosteen *In its* CTOL Transport Technol., 1978 Jun. 1978 p 235-237 (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 11D

N78-27061*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ENVIRONMENTAL EFFECTS ON COMPOSITES FOR AIRCRAFT
Richard A. Pride *In its* CTOL Transport Technol., 1978 Jun. 1978 p 239-258 refs (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 11D

N78-27062*# Lockheed-California Co., Burbank.
DEVELOPMENT OF ADVANCED COMPOSITE STRUCTURES
Warren A. Stauffer and Arthur M. James *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 259-279 (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 11D

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N78-27190 Kansas Univ., Lawrence.
ISOTHERMAL P-x DATA AND PHASE EQUILIBRIUM BEHAVIOUR IN THE ISOPENTANE-n-PENTANE-ISOPRENE SYSTEM (100 F-120 F) Ph.D. Thesis
Randolph A. Kpokpo Weah McClain 1977 258 p
Avail: Univ. Microfilms Order No. 7809418

For the binary and ternary systems composed of isopentane, n-pentane and isoprene from 100 F to 120 F, isothermal total pressure-liquid composition (P-x) data have been obtained using a static vapor-liquid equilibrium apparatus. The static apparatus has the following major assets: visual bubble point pressure observation and the ability to permit loading and venting (degassing) from the top of the experimental cell. The results confirmed binary azeotropism in the n-pentane-isoprene system. Over the temperature and pressure range of the investigation, no ternary azeotrope was observed in the isopentane-n-pentane-isoprene system. Thus conventional distillation, probably via superfractionation, can now be considered as an alternative to extractive distillation for purifying isoprene using isopentane in excess. Dissert. Abstr.

N78-27191 Mississippi State Univ., State College.
KINETIC AND MASS TRANSFER STUDIES OF OZONE-PHENOL REACTIONS IN LIQUID-LIQUID AND GAS-LIQUID SYSTEMS Ph.D. Thesis
Ku-Yen Li 1977 329 p
Avail: Univ. Microfilms Order No. 7807579

Kinetic experiments were carried out at temperatures ranging from 6 to 35 C and pH values varying from 2 to 12 using stopped-flow and gas chromatographic methods. A gas-liquid contacting reactor was utilized to investigate the mass transfer process at 25 C with various gas flow rates and pH values of the solution. A chain-reaction mechanism has been proposed for decomposition of ozone in aqueous solutions. Both the rate equation and kinetic data indicated that the acidity was an important factor influencing the reaction and that the decomposition was three-halves order with respect to ozone concentration. The results suggest that in ozone treatment of phenolic waste it is advantageous to maintain pH value of the solution near neutrality. Dissert. Abstr.

N78-27192 Case Western Reserve Univ., Cleveland, Ohio.
THE ORGANIZATION AND CRYSTALLITE SIZES OF COLLAGEN Ph.D. Thesis
Rita Kam-Chi Lam 1978 137 p
Avail: Univ. Microfilms Order No. 7809290

Freeze etching was used to study mucopolysaccharide (MPS) containing interconnecting fibrils associated with collagen as a function of age. Three morphologically different forms of interconnecting fibrils were observed: long, thin fibrils; short interconnecting fibrils and network type fibrils. MPS-specific enzymes were used to characterize these fibrils. The former two types were not observed after enzyme treatment. The network type fibrils could only be removed by elastase. In addition, MPS were also found to occur as fine striations circumscribing collagen fibrils at specific locations. The long, thin fibrils were only observed in young collagenous tissues. No age dependence was found for the short, interconnecting fibrils, networks and striations. It was also found that the collagen fibril is composed of spiraling filaments of about 150 angstroms in diameter. Dissert. Abstr.

N78-27193 Wisconsin Univ. - Madison.
APPLICATIONS OF GAS CHROMATOGRAPHIC REACTORS Ph.D. Thesis
Thomas David Griffith 1977 358 p
Avail: Univ. Microfilms Order No. 78-04420

A modified version of an earlier GCR was constructed with alternating packed and empty columns. Two empty (void) columns were placed between three packed columns. Five detectors were also placed with one after each column including the final column. Kinetic measurements of the unimolecular, first order dissociations of dicyclopentadiene and the three dimers of methylcyclopentadiene were used to validate the newly devised Multi-Void Gas Chromatographic Reactor (MVGCR). These dissociation reactions occurred in both the gas and liquid phases in the packed columns and only in the gas phase in the void columns. The detector responses were used to measure the reactant retention time in each column. Product area measurements combined with independently varying values of gas phase and liquid phase retention times were fitted by a nonlinear, multi-variable, least

squares regression analysis to a model described in this dissertation. Dissert. Abstr.

N78-27194 Wisconsin Univ. - Madison.
DETERMINATION OF NITROGEN AND OXYGEN MASS TRANSFER BY GAS CHROMATOGRAPHIC TECHNIQUES Ph.D. Thesis
Torleiv Bilstad 1977 200 p
Avail: Univ. Microfilms Order No. 78-04403

The reason for preferential nitrogen absorption during aeration and the prevention of excessive nitrogen supersaturation are discussed. Theoretical analysis indicate that preferential nitrogen absorption results primarily from the lower nitrogen solubility in water as compared to oxygen, ant that it is aggravated by the use of small air-water ratios. Dissert. Abstr.

N78-27195 Stanford Univ., Calif.
THE OXIDATION OF ALCOHOLS ON COPPER (110) AND SILVER (110) CATALYSTS Ph.D. Thesis
Israel Ephraim Wachs 1978 272 p
Avail: Univ. Microfilms Order No. 7808861

The interaction of methanol with the partially oxidized copper (110) and silver(110) crystals was examined using the modern tools of surface science. The catalytic surfaces were preoxidized with oxygen-18, and deuterated methanol, CH3OD, was used to distinguish the hydroxyl hydrogen from the methyl hydrogens in the reaction products. The interaction of CH3OD with these partially oxidized surfaces was monitored by the method of temperature programed reaction spectroscopy. The results demonstrate that the interaction of alcohols with partially oxidized copper(110) and silver(110) surfaces formed surface alkoxides and water upon adsorption. The surface oxygen atoms created the active sites for the dissociative adsorption of alcohols, and interacted with the alcohols through their hydroxyl hydrogens. The alkoxides were the most abundant surface intermediates and were responsible for the production of the aldehydes.
Dissert. Abstr.

N78-27196 Kansas Univ., Lawrence.
A PHOSPHORESCENCE MICROWAVE DOUBLE RESONANCE STUDY OF SEVERAL HYDROXYBENZALDEHYDES Ph.D. Thesis
Kenneth Alan Martin 1977 252 p
Avail: Univ. Microfilms Order No. 78-09364

The effects of inter- and intramolecular hydrogen bonding on the lowest triplet state of ortho-, meta- and para-hydroxybenzaldehyde were studied. The above guest molecules are evaluated as doped single crystals of a series of solvent (host) systems: p-xylene, phenol, benzoic acid and p-dichlorobenzene. The vibronic spectra were correlated with total phosphorescence decay rate constants and zero field splittings, and the nature of the lowest triplet state was defined for each of the systems. The characteristics of these states are then discussed in terms of inter-and intramolecular hydrogen bonding and the external heavy atom effect. Dissert. Abstr.

N78-27197 California Univ., Davis.
THE ELECTROCHEMICAL-MECHANICAL OSCILLATORS THE BEATING MERCURY HEART Ph.D. Thesis
Shui-Wai Lin 1977 182 p
Avail: Univ. Microfilms Order No. 7809240

Physical and chemical effects on the voltage-time oscillations of the mercury in oscillators of the types Al(w) NaOH(aq), NaCL(aq), electron-receptor(aq) Hg(1), Ma(W) H2SO4(H2O) or (D2SO)(D2O) Hg(1), and Fe(W) H2SO4(aq), K2Cr2O7(aq) or KMnO4(aq) Hg(1) are described. The period of the oscillation of the mercury was affected significantly only by the diameter of the tube which contained the mercury and by the critical distance of 0.45 cm of the W-tip horizontally away from the center of the tube at a vertical separation of 0.04 mm between the W-tip and the surface of the mercury. The peak height of the voltage-time trace of the oscillation of the mercury depended on a number of physical and chemical factors. Dissert. Abstr.

N78-27198 Cornell Univ., Ithaca, N. Y.
HIGH SENSITIVITY DERIVATIVE SPECTROSCOPY Ph.D. Thesis
Edward Ira Moses 1978 116 p
Avail: Univ. Microfilms Order No. 7809502

An extension of a method of doing high sensitivity wavelength modulation derivative spectroscopy is discussed and experimentally demonstrated. The system uses a dual beam, single detector optical configuration, the reference beam containing information about the empty spectrophotometer, and the sample beam containing, information about the empty spectro-photometer, in addition, information about some optical properties of the sample being studied. The unique feature which allows for the unprecedented high sensitivity is that the frequency of the modulation is smaller than the chopper frequency and, consequently, lies within the common mode bandwidth of the device. A novel method of feedback normalization is presented. Used in conjunction with an electro-optically tunable cw dye laser, this method and feedback system give an unprecedented sensitivity of 0.000001/A for modulation depths from 1 to 50 A. The derivative spectrum of the extremely weak fifth overtone vibrational transition within the electronic ground state of benzene is observed for the first time in a path length as short as one cm.
Dissert. Abstr.

N78-27199 Pittsburgh Univ., Pa.
KINETIC STUDIES OF GAS PHASE REACTIONS OF Cl ATOMS AND ClO AND OH RADICALS OF IMPORTANCE IN THE STRATOSPHERE Ph.D. Thesis
Mark Stuart Zahniser 1977 188 p
Avail: Univ. Microfilms Order No. 78-09561

Gas phase reactions of Cl atoms and of the ClO and OH radicals were studied using the discharge flow technique with resonance fluorescence detection to obtain rate constants as a function of temperature within the range of 200 K to 500 K. The sensitivity of the detection technique, about one billion atoms or radicals cu cm enabled these reactions to be studied with initial atom or radical concentrations low enough so that a single elementary step is isolated without interference from secondary reactions. The importance of the reactions in the photochemistry of stratospheric ozone, and the necessity of their rate coefficients in assessing the possibility of ozone depletion by the release of man-made chlorine compounds is discussed. Rate constants for the reactions of Cl with O3 and CH4 and of OH with HCl were measured directly by observing the first order removal of Cl or OH in the presence of a large excess of the stable reaction partner. Dissert. Abstr.

N78-27200 Pittsburgh Univ., Pa.
GAS PHASE HYDROGEN ATOM RECOMBINATION Ph.D. Thesis
Lloyd Peter Walkauskas 1977 141 p
Avail: Univ. Microfilms Order No. 7809559

Gas phase recombination reactions of hydrogen atoms were studied in a flow reactor using isothermal probe calorimeter detection of H-atoms and production of atoms by dissociation of H2 on a hot wire filament. In addition, the ortho-para ratio of the recombined hydrogen produced in the termolecular reaction H + H + M yields H2 + M, was measured for M = He. The reaction H + H + M yields H2 + M was studied for M = N2, CH4, CO2 and SF6 over the temperature range 77-295 K for the first two third bodies and approximately 295-160 K for the second two. All four studies exhibit the expected negative temperature dependence. The ortho-para ratio of hydrogen recombined at 77 K with M = He was measured by gas-solid chromatography. The termolecular recombination reactions of H-atoms with NO and O2, were also studied in the flow reactor with M = H2. The reaction with NO was studied over the temperature range 295-148 K. Dissert. Abstr.

N78-27201 Houston Univ., Tex.
PHOTOIONIZATION AT THRESHOLD OF N2CO2, AND BF3 Ph.D. Thesis
Joseph Ashley Taylor 1977 152 p
Avail: Univ. Microfilms Order No. 7808113

The construction of an instrument capable of measuring the simultaneous photoion and threshold photoelectron spectra (TPES) is described in detail. The instrument incorporates a 1 meter vacuum UV monochromator to disperse the light from the Hopfield continuum produced by a high power pulse generator. Electron energy discrimination is accomplished by using a collimated hole structure which operates on the principle of angular

discrimination of electrons possessing more than thermal velocities. Results from the TPES indicate that the molecular geometry is distorted upon ionization, that production of BF3(+) occurs with low probability at threshold, and the autoionization may be responsible for the contrast between photoelectron spectra and the TPES. The paucity of vibrational structure in the TPES is discussed in terms of various fragmentation processes.
Dissert. Abstr.

N78-27202 Brown Univ., Providence, R. I.
ENERGY TRANSFER IN DIATOM-ATOM COLLISIONS: THE ELASTIC AND INELASTIC SCATTERING OF CESIUM IODIDE BY ARGON AND XENON Ph.D. Thesis
Neal Albert Sondergaard 1977 115 p
Avail: Univ. Microfilms Order No. 7809096

Velocity and angular distributions of CsI scattered by Ar and Xe were measured. The primary beam of CsI was produced by a partial jet expansion from an oven at 1200 K. As a result of the expansion, the internal modes of the diatom are partially cooled and the internal energy, before collision with the cross beam, can be described by a temperature of 844 K. No rainbow structure was observed in the angular distributions of the CsI scattered by Ar in spite of the wide range of relative energies examined. However, there was structure observed at the nominal cutoff angle. The structure shifted toward the center of mass angle with increasing energy indicating fewer super elastic collisions. The velocity distributions of the diatom-atom systems were analyzed for the relative contribution of elastic and inelastic scattering.
Dissert. Abstr.

N78-27203 Princeton Univ., N. J.
RESONANCE RAMAN STUDIES OF COBALT 2 AND IRON 3 COMPLEXES RELATED TO BIOLOGICAL SYSTEMS Ph.D. Thesis
Simon Salama 1978 201 p
Avail: Univ. Microfilms Order No. 7807495

Resonance Raman spectra of cobalt(2)-imidazole, cobalt(2)-thiourea, ferric-enterobactin and ferric-catecholate type complexes, were obtained using laser excitation in the visible and near-ultraviolet region. These complexes serve as models for the metal binding sites in cobalt substituted zinc proteins and iron chelator compounds, respectively. For the cobalt model complexes, excitation in the visible absorption band enhances the cobalt-ligand modes. The intensity patterns suggest a vibronic mixing mechanism with charge transfer upper states. The cobalt(2)-thiourea complexes present anomalous excitation profiles. Enhancement of metal-sulfur and metal-halide modes in a clear region of the absorption spectrum is observed. These maxima are ascribable to constructive interference between the scattering mechanisms of the different spin-orbit splitting components of the ligand field transition.
Dissert. Abstr.

N78-27204 Colorado Univ., Boulder.
SPECTROSCOPY AND EMISSION LIFETIMES OF SULFUR DIOXIDE Ph.D. Thesis
Raymond Neil Rudolph 1977 198 p
Avail: Univ. Microfilms Order No. 7808932

A basic understanding of the sulfur dioxide molecule is important because SO2 has a potential role in photochemical smog production in polluted atmospheres. The lower lying excited electronic states of SO2 which participate in photochemical reactions have defied a complete characterization. Spectroscopic and photophysical data which illucidate the nature of the lower lying electronic states of SO2 and the processes by which these states interconvert were obtained. Absorption and excitation spectra of crystalline SO2 are presented. An unexpected large clue shift in the crystal absorption over that of the gas phase absorption is discussed. Unsuccessful attempts to obtain a two photon excitation spectrum of the crystal are also discussed.
Dissert. Abstr.

N78-27205 Case Western Reserve Univ., Cleveland, Ohio.
SOME PHOTOCHEMICAL REACTIONS OF AQUEOUS NITROUS ACID Ph.D. Thesis
Timothy Richard Rettich 1978 95 p
Avail: Univ. Microfilms Order No. 7809308

Aqueous nitrous acid solutions at 1 C were photolyzed in the banded ultraviolet absorption region (between 300 and 400 nm). The quantum yield of nitrous acid disappearance was measured under various conditions and was corrected for the concurrent thermal reaction. The quantum yield increased linearly from zero at zero nitrous acid concentration to 0.14 to 0.14M nitrous acid. For higher concentrations, the quantum yield remained constant at 0.14. Mechanisms were proposed for the photolysis reaction in the presence and absence of added scavengers which satisfy the observed stoichiometries and kinetics. In addition, values for the quantum yield of escape from the cage (0.095 + or - .005) and for the quantum yield limit at high concentrations (0.140 + or - .005) are predicted to be related by a factor of 1.5 based on the proposed mechanisms. The ratio of the experimentally determined values is 1.47 + or - .13.
Dissert. Abstr.

N78-27206 Wisconsin Univ., Madison.
HYPERFINE AND SPIN-ROTATION INTERACTIONS IN THE HYDROGEN MOLECULE-ION Ph.D. Thesis
Roger Dean Ray 1977 210 p
Avail: Univ. Microfilms Order No. 7804441

Fermi contact, dipole-dipoles and electron spin-rotation interactions in the ground electronic states of H2(+) and Hd(+) were calculated. Results characterize the interaction coefficients both as functions of the internuclear separation and as constants specific to the vibrational-rotational states of the two molecules. In the case of HD(+) the spectroscopic constants were used to simulate the hyperfine structure which is manifested in its vibrational-rotational transitions. The simulation involves calculating the hyperfine energies characteristic of each vibrational-rotational level participating in the transition and the relative intensities for each hyperfine component in the resonance as well as assigning line shapes and widths commensurate with the experimental conditions.
Dissert. Abstr.

N78-27207 Cornell Univ., Ithaca, N. Y.
HIGH TEMPERATURE MASS SPECTROMETRIC STUDIES OF ION-MOLECULE REACTIONS OF METAL SYSTEMS Ph.D. Thesis
Pui Leong Po 1977 127 p
Avail: Univ. Microfilms Order No. 7807793

A high temperature ion-molecule reactor is described for experimental investigations of ion-molecule reactions of metal vapors. This technique is applied to a study of charge and proton transfer reactions of Mg and Zn atoms with a series of protonated ions. In the magnesium system D3(+) reacts with Mg(g) exclusively by a charge transfer process. In the zinc system, H3(+) reacts with Zn(g) by charge and proton transfer mechanisms. The bimolecular rate constant for the exothermic proton transfer process decreases rapidly with increasing internal energy of the reactant ions. In the presence of solid magnesium, Mg(+)(g) and MgH(+)(g) undergo chemical reactions at elevated temperatures to form Mg2(+)(g) and Mg2H(+)(g), respectively. Experimental evidence presented indicates that the mechanism of these reactions involves direct interaction of the reactant ions with the magnesium surface.
Dissert. Abstr.

N78-27208 Johns Hopkins Univ., Baltimore, Md.
LASER-INDUCED-FLUORESCENCE STUDIES OF CHEMICAL REACTIONS Ph.D. Thesis
Louise Rebecca Pasternack-Rafferty 1978 127 p
Avail: Univ. Microfilms Order No. 7806267

Reactions of M + BrCN where M = Ca, Sr, and Ba, velocity selected Al + O2, Ca + O2, and Ca + CO2 have been studied under single collision conditions using laser induced fluorescence. In the M + BrCN reactions, the dominant pathway is the formation of MCN; however for the Sr and Ba reactions weak features, MBr and CN, due to the other possible pathway, were also observed. The dominant features of their excitation spectra are broad quasicontinua several hundred angstroms wide which occur at the same wavelengths as the spectra of the alkaline earth monohalides. Radiative lifetimes of the MCN electronic states have been determined by direct observation of the fluorescence decay after pulsed laser excitation. The effect of incident translational energy on the product internal state distribution was investigated for the reaction Al + O2 yields Al O + O.
Dissert. Abstr.

N78-27209 Texas Univ., Austin.
THERMAL DECOMPOSITION OF ETHANE Ph.D. Thesis
Douglas Bernard Olson 1977 105 p
Avail: Univ. Microfilms Order No. 7807357

The decomposition of C2H6 in Ar was studied by laser-absorption and laser-schlieren measurements of the reaction rate behind incident shock waves. The experimental profiles were parameterized by suitable measures of reaction progress. Computer simulations using a 14-reaction mechanism were used to compare assumptions about rate constant expressions with the experimental parameters and to investigate the sensitivity of computed parameters to these assumptions. A critical configuration model using a minimum density-of-states criterion for defining the critical configuration and a hindered rotor description for the four degrees of freedom that are converted from vibrations in the molecule to free rotations of the methyls was found to give a substantially better description of the data than any vibrator or free rotor model. Dissert. Abstr.

N78-27210 North Carolina Univ. at Chapel Hill.
NUCLEAR MAGNETIC RESONANCE STUDIES OF THE CONFORMATIONAL PROPERTIES OF 2', 3'-ISOPROPYLIDENE ADENOSINE Ph.D. Thesis
Jack Thomas McCown 1977 134 p
Avail: Univ. Microfilms Order No. 7807151

The nuclear magnetic relaxation rates of both selected protons and C-13 nuclei were investigated as a function of temperature for the nucleoside 2,', 3'-isopropylidene andenosine and its deuterated analogue 8-deutero-2', 3'-isopropylidene adenosine. The studies were conducted in dimethyl sulfoxide solution over approximately a 90 C temperature interval. Using the proton differential relaxation rates computed from the relaxation rates of the deuterated and nondeuterated material and the rotational correlation times found in the carbon studies, it was proven possible to follow with some degree of accuracy a single conformationally averaged internuclear distance as a function of temperature. Dissert. Abstr.

N78-27211 California Univ., Davis.
THE COVALENT ATTACHMENT OF BIFUNCTIONAL CHELATES TO BIOMOLECULES AND THEIR USES AS PHYSICAL PROBES IN BIOLOGICAL SYSTEMS Ph.D. Thesis
Charles Siu-Huen Leung 1977 227 p
Avail: Univ. Microfilms Order No. 7809238

By means of diazonium coupling and also by alkylation reactions, para-substituted derivatives of 1-phenyl-EDTA were attached to the proteins albumin and fibrinogen and to the anti-tumor drug bleomycin. Sites and extent of labeling under different reaction conditions were studied by several physical and chemical techniques, including carbon-14 measurement, fluorometric titration, spectroscopic determination, polyacrylamide gel electrophoresis, and amino acid analysis. Procedures were developed whereby radioactive isotopes of indium can be added rapidly and specifically to protein-bound chelating groups. The stability of these chelates in vitro and in vivo in human volunteers was investigated. The use of these radioactive compounds as tumor scanning radiopharmaceuticals has been explored.
Dissert. Abstr.

N78-27212 Houston Univ., Tex.
UV AND X-RAY PHOTOELECTRON SPECTROSCOPY AND THEIR APPLICATIONS TO CHEMICAL SYSTEMS Ph.D. Thesis
Ting Ho Lee 1977 165 p
Avail: Univ. Microfilms Order No. 7808108

The combination of UV and X-ray photoelectron spectroscopy with quantum mechanical methods to provide a complete and firm assignment of the occupied energy levels of a molecular system is discussed. The theoretical aspects involve semiempirical methods such as EH(extended Huckel), CNDO(complete neglect of differential overlap), and INDO(incomplete neglect of differential overlap) molecular orbital calculations and photoionization cross sections calculated within the orthogonalized plane-wave approximation. The applications presented are the calculations of one-electron orbital energies and molecular wavefunctions of the occupied orbitals or chromyl chloride, hydrazoic acid, the azide ion, N,N-dimethylnitramine, and N,N-dimethylnitrosamine. EHMO theory is also used to develop a model for the adsorption of CO on several W(100) sites. Dissert. Abstr.

N78-27213 Stanford Univ., Calif.
X-RAY ABSORPTION STUDIES OF HEMOCYANIN Ph.D. Thesis
Thomas Keith Eccles 1978 143 p
Avail: Univ. Microfilms Order No. 7808783

The copper atoms in the active site of keyhole limpet hemocyanin were studied by X-ray absorption spectroscopy. Deoxygenated, oxygenated, carboxylated, and nitric oxide-treated hemocyanin were studied. The X-ray absorption edge and the extended X-ray absorption fine structure (EXAFS) regions of the spectra were analyzed separately, both by comparison to copper model compounds. The room temperature EXAFS results predict 3 or 4 oxygen and/or nitrogen first shell atoms around the copper in deoxyhemocyanin and either 5 or 6 atoms for both oxyhemocyanin and nitric oxide-treated hemocyanin. First shell distances are predicted to be 1.99, 1.96, and 2.01 angstroms for deoxy, oxy, and nitric oxide-treated hemocyanin respectively, with an estimated uncertainty of 0.04 angstroms. No copper-sulfur or copper-copper distance is found below 2.8 angstroms in any of the forms of hemocyanin studied. Dissert. Abstr.

N78-27214 Pittsburgh Univ., Pa.
LASER INDUCED FLUORESCENCE LIFETIME AND QUENCHING STUDIES OF GASEOUS NITROGEN DIOXIDE Ph.D. Thesis
Vincent Michael Donnelly 1977 224 p
Avail: Univ. Microfilms Order No. 7809118

Radiative lifetimes and fluorescence quenching rate constants of the perturbed B2-2 state of NO2 were measured, using pulsed laser excitation between 473 and 659 nm, and modulated excitation at 632.8 nm. Low resolution (0.8 and 3.4 nm) fluorescence spectral were measured as a function of pressure between 0.01 and 886 motor. The time dependence of the fluorescence was measured as a function of pressure, following pulsed excitation to obtain quenching rate constants of banded and continuum features. All of the observations strongly support a stepwise deactivation model. The dependence of the fluorescence spectrum on NO2 pressure can be explained by ascribing the slow process to vibrational quenching, with about 1000/cm being lost per quenching collision. The fast process seems to be associated with a rational energy transfer. Dissert. Abstr.

N78-27215 Stanford Univ., Calif.
CHEMICAL APPLICATIONS OF X-RAY ABSORPTION SPECTROSCOPY-NITROGENASE AND CYTOCHROME P-450 Ph.D. Thesis
Stephen Paul Cramer 1978 260 p
Avail: Univ. Microfilms Order No. 7808775

Techniques are described for obtaining structural information from X-ray absorption spectra, and the application of these techniques to the metalloenzymes nitrogenase, crytochrome P-450, and chloroperoxidase. X-ray absorption spectra have been collected using synchrotron radiation at SSRL for a variety of mononuclear and dinuclear molybdenum complexes containing carbon, nitrogen, oxygen, and sulfur donor atoms. The extended X-ray absorption fine structure, EXAFS, of Mo K absorption edge was analyzed by a method which combines Fourier transform and curve-fitting techniques. Parameterized pairwise phase shift and amplitude functions for describing Mo-C, Mo-N, Mo-O, Mo-S, and Mo-Mo interactions were obtained from model compound spectra. Application of these functions to the EXAFS of other compounds yielded distance determinations consistently better than 0.03 for atoms bound to Mo. The number and type of coordinating atoms were also determined with a reasonable degree of certainty. Dissert. Abstr.

N78-27216 Pittsburgh Univ., Pa.
BARE EARTH INTERMETALLIC COMPOUNDS AS CATALYSTS FOR THE HYDROGENATION OF CARBON MONOXIDE Ph.D. Thesis
Victoria Tan Coon 1977 106 p
Avail: Univ. Microfilms Order No. 7809549

Rare earth intermetallic compounds are found to become effective catalysts for the formation of ethane from H2 and CO when heated in a gas stream of the reaction mixture. Binary

systems such as RNi5 (R = La, Ce, Gd, Tb, Ho, Er and Yb), CeCo5, and ErFe2 were studied in a continuous flow system with a CO/3H2 gas mixture using a microcatalytic fixed-bed reactor. Major products are CH4, CO2, H2O, some ethane and minute quantities of ethylene. Traces of propane and butane were observed for some catalysts. Activation energies range from 10 to 30 kcal/mole. A compensation effect (the log of the Arrhenius pre-exponential factor increasing linearly with activation energy) is observed for the RNi5 samples and a commercial Ni(G-52) catalyst. The CeCo5 clearly deviates from the RNi series. Dissert. Abstr.

N78-27217 Brown Univ., Providence, R. I.
STUDIES IN THE HYDROGEN BONDING OF LIQUID WATER, AMORPHOUS WATER AND WATER OLIGOMERS Ph.D. Thesis
Robert Ernest Barletta 1977 214 p
Avail: Univ. Microfilms Order No. 78-09031

Various aspects of hydrogen bonding in amorphous water, water oligomers, and liquid water were investigated. In infrared studies of amorphous water deposited at 15K, it was observed that the spectrum obtained differed considerably from those previously reported. Upon annealing of the sample, it was found that the spectrum began to change indicating the transition of part of the sample from amorphous water to ice Ic. These changes were reflected by changes in the component bands of the band envelop in the O-H stretching region. The infrared spectroscopy of water oligomers, particularly of the water dimer was investigated using the technique of matrix isolation. H2O and D2O were isolated in solid N2 matrices in various host to guest ratios ranging from 500:1 to 30:1. The normalized intensity of the bands observed in the infrared were plotted vs. the cube root of the host of guest ratio. In all, 10 bands were assigned to dimer vibrations in the region of 4000 to 15000/cm. A normal coordinate analysis was performed and it was found that some of the observed infrared bands assigned to dimer vibrations were due to dimers in other than possible configurations. Eight dimer vibrations were assigned to observed bands in the mid and far infrared and the force constants associated with these vibrations were calculated. Finally, a description of experiments investigating the O-16/O-18 fractionation in the D2O liquid vapor system was presented. Dissert. Abstr.

N78-27218 Colorado State Univ., Fort Collins.
SILVER-109 NUCLEAR MAGNETIC RESONANCE Ph.D. Thesis
Joseph John Henry Ackerman 1977 103 p
Avail: Univ. Microfilms Order No. 78-07414

The development of Ag-109 nuclear magnetic resonance as a probe of Ag(1) solution chemistry is described. Spectrometer modification that allows routine observation of nuclides with resonance frequencies in the range of 2-50 MHz are employed and discussed. The chemical systems examined are composed of either AgNO3 or AgClO4 in solutions of acetonitrile, dimethylsulfoxide and water. The Ag(1)-109 chemical shift is studied as a function of silver salt concentration, anion concentration, and solvent composition in binary solvent mixtures. The Ag(1)-109 chemical shift is found to be specific sensitive to the following parameters: (1) solvent; (2) formation of specific solvent Ag(1) complexes; (3) ion pair interactions; (4) preferential solvation; and (5) heteroselective solvation. Some possible experimental techniques for improving the Ag-109 nmr (signal:noise) are reviewed. Dissert. Abstr.

N78-27219 Brown Univ., Providence, R. I.
SPECTROSCOPIC STUDIES OF INORGANIC COMPOUNDS. 1: METAL-METAL BONDING IN THE SERIES X3MM'(CO)4-n. 2: ION MOTION IN MONO- AND DIVALENT DERIVATIVES OF SODIUM BETA ALUMINA. 3: ION MOTION IN DRY AND SOLVATED X AND Y ZEOLITES EXCHANGED WITH GROUP 1 AND 2 IONS Ph.D. Thesis
Wayne Michael Butler 1977 361 p
Avail: Univ. Microfilms Order No. 78-09038

The infrared and laser Raman spectra of the isostructural series of molecules X3MFe(CO)4(-) (M = Ge, Sn; X = Cl, Br) are reported and 16-19 of the 20 expected fundamentals for each ion have been observed and assigned. Complete vibrational analyses of these compounds and those of the isostructural and isoelectronic series X3MCo(CO)4 (M = Ge, Sn; X = Cl, Br, I) have been carried out under a uniform set of force field approximations. A close calculated-observed spectral agreement was obtained while holding the force fields for the M prime(CO)4 moiety constant through the respective series and varying only the constants associated with the MX3 moieties. Dissert. Abstr.

N78-27220 Lehigh Univ., Bethlehem, Pa.
THE ELECTROCHEMICAL OXIDATIVE COUPLING REACTIONS OF 2-AMINO-5-CHLOROBENZOPHENONE Ph.D. Thesis
Glenn David Zoski 1978 176 p
Avail: Univ. Microfilms Order No. 7808083

The electrochemical oxidation of 2-amino-5-chlorobenzophenone at a platinum electrode in acetonitrile was undertaken. Cyclization of the benzophenone to form the corresponding 9-acridanone was expected; however, the cyclization did not occur but rather dimerizations similar to those found in aniline oxidation were discovered. Several electrolyses leading to nonisolable products were performed. The 2-amino-5-chlorobenzophenone was oxidized in a one-electron oxidation at +1.160 vs. aG/AgCl (saturated NaCl). A value for the diffusion coefficient was determined as well as the heterogeneous rate constant for the electron transfer. Several mechanisms consistent with the experimental data are proposed. Rate constants for the hydrolysis reaction are determined. Dissert. Abstr.

N78-27221 Duke Univ., Durham, N. C.
PROTON INDUCED X-RAY EMISSION (PIXE) AND APPLICATIONS TO ELEMENTAL ANALYSIS Ph.D. Thesis
Robert Dalton Willis 1977 464 p
Avail: Univ. Microfilms Order No. 7807642

A Proton Induced X-ray Emission (PIXE) system was developed with application to elemental analysis of biological, medical, and environmental samples. The system utilizes a 3 MeV beam of protons to excite characteristic X-ray emission from the bombarded sample. A solid-state Si(Li) detector is used to detect a fraction of the emitted X-rays. The present system provides moderately low detection limits for elements heavier than sulphur. Two computer programs are described which facilitate the analysis of PIXE data. A comparison of the PIXE technique with the X-ray Fluorescence method indicates similar detection limits for the two methods. Future improvements are described for optimizing and extending the analytical capabilities of the present system. Advantages and disadvantages of the PIXE technique are sumarized. Dissert. Abstr.

N78-27222 Louisiana State Univ. and A&M Coll., Baton Rouge.
A PYROLYTIC METHOD FOR THE DETERMINATION OF SULFATE IN WATER Ph.D. Thesis
LeeAnn Marie Thoma 1977 170 p
Avail: Univ. Microfilms Order No. 78-07562

Work on a sulfuric acid aerosol determination led to the development of a new sulfate procedure, which appeared to be applicable to water analysis. This dissertation contains the results of an investigation of this method, which included a study of the potential interferences and how they might be removed, and the development of a procedure for determining sulfate in drinking and natural waters. The actual procedure utilized three distinct, separate sulfate reactions: a precipitation reaction, a pyrolysis reaction, and a colorimetric reaction. Dissert. Abstr.

N78-27223 Oregon State Univ., Corvallis.
MULTIELEMENT ATOMIC ABSORPTION AND FLUORESCENCE SPECTROMETRY Ph.D. Thesis
Eric Dunbar Salin 1978 234 p
Avail: Univ. Microfilms Order No. 7808660

A multielement spectrometer was developed for the simultaneous determination of four elements by atomic absorption (AA) or atomic fluorescence (AF). The spectrometer is based on a multiple exit slit monochromator and uses a mirrored funnel to direct light from the various exit slits to a single photomultiplier. A single element hollow cathode (HC) lamp is used for each element. The HC beams are combined for AA by beam splitters and directed along the optical axis through the atmomizer into the monochromator entrance slit. HC lamp pulsing and data acquisition are implemented by a time multiplex approach. The HC lamp pulsing is controlled by simple digital circuitry which

sequentially pulses each HC lamp and digitally integrates HC and background signals for each element at a 100 Hz rate for up to 256 cycles. The system presently allows the determination of any four of 10 possible elements for which slits were made. With the present configuration a 200 nm spectral window can be utilized allowing the determination of any 4 of 27 elements in an air/C2H2 flame or of 24 in a N2O/C2H2 flame if the slits are manufactured. Dissert. Abstr.

N78-27224 Duke Univ., Durham, N. C.
LIQUID CHROMATOGRAPHIC STUDIES OF CHEMICALLY BONDED, CHARGE-TRANSFER COMPLEXING STATIONARY PHASES Ph.D. Thesis
Ralph Reynolds Ryall 1977 143 p
Avail: Univ. Microfilms Order No. 7807630

Studies were undertaken to determine the liquid chromatographic performance of several related, chemically bonded stationary phases. A common feature of many of the bonded phases is an electron-deficient, aromatic ring system that is capable of interacting through charge-transfer forces with pi-electron-donor solutes. Systematic variations in the molecular structure of these bonded phases were investigated with respect to the influence on chromatographic retention and selectivity for several polycyclic aromatic hydrocarbons (PAH), including both geometrical and optical isomers. Dissert. Abstr.

N78-27225 Minnesota Univ., Minneapolis.
THE ANALYTICAL CHEMISTRY OF POTASSIUM CYANATE WITH PARTICULAR EMPHASIS ON ITS DETERMINATION IN BIOLOGICAL MATERIALS Ph.D. Thesis
Nile Nelson Frawley 1977 217 p
Avail: Univ. Microfilms Order No. 7809660

Cyanate reacts with mercaptans in slightly acid solution to form thiocarbamates. Polarography was used to investigate the rates of the reactions involved as a function of pH for several different mercaptans. From these experimental data it was determined that aromatic sulfhydryls react more rapidly with cyanate than their aliphatic counterparts. Near pH 8 it was found that the forward reaction which produces the thiocarbamate is quantitatively reversed to give back the starting materials (cyanate plus mercaptan). Based on these observations an extraction method for the removal of cyanate from aqueous solutions via its reaction with benzenethiol was developed; 96% of the cyanate initially present is removed from an aqueous solution with one benzenethiol extraction using this method. Following the extraction, cyanate can be regenerated in basic solution quantitatively free from other interfering ions. Dissert. Abstr.

N78-27226* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TARGETS FOR PRODUCING HIGH PURITY I-123 Patent
James W. Blue, inventor (to NASA) Issued 9 May 1978 7 p Filed 4 Sep. 1973 Supersedes N74-10476 (12 - 1, p 0060) Continuation-in-part of abandoned US Patent Appl. SN-266927, filed 28 Jun. 1972, which is a continuation in-part of US appl. SN-863280, filed 2 Oct. 1969, US Patent-3,694,313 (NASA-Case-LEW-10518-3; US-Patent-4,088,532; US-Patent-Appl-SN-394207; US-Patent-Class-176-11; US-Patent-Class-176-16; US-Patent-Class-250-400; US-Patent-Class-250-429; US-Patent-Class-250-492B; US-Patent-3,694,313; US-Patent-Appl-SN-266927; US-Patent-Appl-SN-863280) Avail: US Patent Office CSCL 07D

Tellurium powder in improved targets is bombarded with a cyclotron beam to produce Xe-123. Flowing gas streams carry the Xe-123 through one cold trap which removes Xe-123 that subsequently decays to I-123. During this bombardment energy is deposited in the target material causing its temperature to rise. Some of the tellurium vaporizes and subsequently condenses on surfaces that are cooler than the vaporization temperature. Provision is made for the repeated bombardment of this condensed tellurium. Official Gazette of the U.S. Patent Office

N78-27227 Case Western Reserve Univ., Cleveland, Ohio.
A THEORY OF FLAME SPREAD OVER A SOLID FUEL INCLUDING FINITE RATE CHEMICAL KINETICS Ph.D. Thesis
Alfred Edwin Frey, Jr. 1978 230 p
Avail: Univ Microfilms Order No 7809277

The flame spread model considers a laminar diffusion flame in a uniform opposed flow and includes the two-dimensional, elliptic, gas-phase energy and species equations with one-step overall chemical reaction and second-order, finite rate Arrhenius kinetics. The unsteady, solid-fuel equations include transient heating and Arrhenius pyrolysis kinetics and are coupled to the quasi-steady gas phase. Two-dimensional distributions of temperature and species were obtained including the low reactivity zone in the flame front region. The solid fuel surface profiles indicated a region of almost uniform temperature during pyrolysis for some parameter values. The dependence of flame spread rate on ambient parameters was investigated and qualitative agreement was obtained with experimental results in the near extinction limit region. The flame extinction limits due to increased opposed velocity, reduced pressure and reduced ambient oxygen mass fraction are all obtained in the results calculated from this theory. Dissert. Abstr.

N78-27228 City Univ. of New York.
ASPECTS OF THE DESIGN AND CONTROL OF FIXED BED CATALYTIC REACTORS Ph.D. Thesis
Jeffrey Lester Silverstein 1978 114 p
Avail: Univ. Microfilms Order No. 78-08696

The design and control strategies for catalytic fixed bed reactors with external heat feedback are often difficult to develop because of the complex nature of the system behavior and that of its component units. It is shown how such a system, with inherent positive feedback, can be analyzed by generating the frequency responses of its component units separately, and then matching and suitably altering them to obtain a desired frequency response and stability margin for the entire system. Two practical examples are offered to illustrate the technique and to show how alterations in the basic system design can sometimes simplify the control problem. The economic penalties of these alterations are discussed qualitatively, and it is indicated that a compromise is often required between increased costs, improved steady state operation, and easier control. Dissert. Abstr.

N78-27229 City Univ. of New York.
FILTRATION OF DUSTS AT 150 DEG C BY A PANEL BED FILTER WITH PUFFBACK Ph.D. Thesis
Ignacio Rodon 1978 431 p
Avail: Univ. Microfilms Order No. 78-08694

The panel bed filter is a particulate collection device in which the constraint to a two-phase flow is a tall narrow bed of granular solids retained between two vertical porous walls. The dirty gas-entry wall comprises louvers that support and expose free surfaces of the solid. A new design for the gas-entry louvers was incorporated in to the filter. This design was found to be appropriate for high-efficiency panel bed filtration of dusts of different characteristics. It was concluded that the size of the granules for the filtration of a given dust at preselected conditions should be such as to provoke the formation of surface filter cakes whose roots did not extend beyond the width of the front louver plate. Dissert. Abstr.

N78-27230 Houston Univ., Tex.
STEADY STATE MULTIPLICITY FOR TWO CONSECUTIVE OR ISOLATED PARALLEL FIRST ORDER REACTIONS Ph.D. Thesis
Constantine Andrew Pikios 1978 171 p
Avail: Univ. Microfilms Order No. 78-08101

A classification is given for the steady state behavioral features of lumped parameter systems in which either two consecutive first order chemical reactions, or two independent first order chemical reactions occur. When both reactions are endothermic, a unique steady state solution exists. When both reactions are exothermic, a maximum of five steady state solutions could occur. When one reaction is exothermic and the other is endothermic a maximum of three steady state solutions may exist. When one reaction is isothermal and the other is endothermic a unique solution exists, while when both reactions are isothermal $y=1$ is the only steady state solution. When the first reaction is exothermic and the second is isothermal, the problem degenerates to that of a single chemical reaction occurring in a lumped parameter system. However, when the first reaction is isothermal

and the second is exothermic, a maximum of five steady state solutions may occur. Dissert. Abstr.

N78-27231 Houston Univ., Tex.
STUDIES IN THE SYNTHESIS OF SEPARATION PROCESSES Ph.D. Thesis
Ravindra Nath 1977 261 p
Avail: Univ. Mcrofilms Order No. 78-08102

Problems related to the synthesis of separation sequences were considered. The main emphasis has been on the synthesis of sharp separation sequences. The synthesis of separation sequence implies the creation of an arrangement of separation units that will isolate species from a given multicomponent feed stream at a minimum cost. The products are specified in terms of desired recoveries and purities. An evolutionary approach is used. The synthesis problem is decomposed into two phases, (1) creation of an initial feasible structure, and (2) evolution of the structures. Several hydrocarbon separation problems have been successfully synthesized as examples of the proposed synthesis procedures. A preliminary investigation of the nonsharp synthesis problem has also been made. A graphical procedure to create an initial structure has been developed for nonsharp separation problems. Dissert. Abstr.

N78-27232*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
FLAME RETARDANT FORMULATIONS AND PRODUCTS PRODUCED THEREFROM Patent Application
Kenneth R. Sidman (Little, (Arthur D.), Inc., Cambridge, Mass.) and Paul Monaghan, inventors (to NASA) (Little, (Arthur D.), Inc., Cambridge, Mass.) Filed 30 May 1978 19 p
(Contract NAS9-13979)
(NASA-Case-MSC-16307-1; US-Patent-Appl-SN-710798) Avail: NTIS HC A02/MF A01 CSCL 07D

An elastomeric coating that significantly increases the flame resistance of a flammable polyurethane foam, without adversely affecting the desirable physical properties of the foam is presented. The coating does not produce smoke, a very significant improvement in crew safety. The innovation is a series of formulations based on flame resistant elastomeric binders, a thermally stable (i.e., to 150 C) source of bromine, metal oxide catalyst/acid acceptors, nitrogen-containing curing agents, phosphorus containing fillers, and hydrated fillers. These formulations can be dispersed in organic liquids (such as acetone, MEK, or hexane) and then sprayed onto the surface of polyurethane foam. After the liquid is evaporated off, a thin elastomeric coating remains on the surface. Alternately, the foam can be saturated with the liquid dispersion, squeezed to remove excess liquid, and then dried. This latter procedure yields a foam that is uniformly treated throughout. The novelty appears to reside in formulations that can be incorporated in formed polyurethane without adversely affecting the characteristics thereof. NASA

N78-27233*# National Aeronautics and Space Administration. Pasadena Office, Calif.
ON-SITE AMMONIA PLANT Patent Application
Wu Yi-Chien, inventor (to NASA) (JPL) Filed 30 Jun. 1978 19 p
(Contract NAS7-100)
(NASA-Case-NPO-14233-1; US-Patent-Appl-SN-920947) Avail: NTIS HC A02/MF A01 CSCL 07D

A small-scale ammonia production system is provided in accordance with this invention that can be operated on a farm or farm cooperative to produce an annual supply of ammonia (about 18 tons) adequate for the average size farm (about 400 acres). The only raw materials in addition to catalyst required for the system are renewable; hydrogen from water and nitrogen from air. The source of electrical power can range from wind power to solar thermal or photovoltaic power and to off-peak utility power tith renewable sources preferred to provide complete on-site sufficiency. The system generally includes an electrolyzer as a source of hydrogen, an air combustion nitrogen generator, and a reactor. A more detailed system is described which illustrates the use of a continuous water stream to produce steam through output which may be utilized for producing power, performing work, or for heating purposes such as the heating of farm houses,, animal shelters, or greenhouses or for the promotion of anaerobic digestion if a digester is incorporated for the treatment of farm waste for the production of methane. The steam can also be used for the generation of electrical power. NASA

N78-27234# Stanford Research Inst., Menlo Park, Calif.
FATE OF HALOGENATED COMPOUNDS IN THE ATMOSPHERE Interim Report, Jul. 1976 - Jul. 1977
Hanwant B. Singh, L. J. Salas, H. Shiegeishi, and A. H. Smith Jan. 1978 65 p refs
(Grant EPA-R-8038020-2)
(PB-278198/7; EPA-600/3-78-017) Avail: NTIS HC A04/MF A01 CSCL 07D

Results involved air monitoring at five urban and nonurban stations with the help of an instrumented environmental mobile laboratory. The monitoring stations included urban, remote marine, remote continental, high altitude and intermediate locations. In situ analysis was performed for a total of 31 chemical species and six meteorological parameters. Of the 31 chemical species sought, 19 were halogenated compounds, five were nitrogen containing species, and the remaining seven included hydrocarbons, CO, and O3. Data suggest that the troposphere (northern hemisphere) contains 2906 ppt of chlorine atoms. GRA

N78-27235# National Bureau of Standards, Washington, D. C. Inst. for Materials Research.
EVALUATION AND RESEARCH OF METHODOLOGY FOR THE NATIONAL ENVIRONMENTAL BANK
T. E. Gills, H. L. Rook, and P. D. LaFleur Feb. 1978 78 p refs
(PB-278512/9; EPA-600/1-78-015) Avail: NTIS HC A05/MF A01 CSCL 07D

A summary of analytical methodologies developed by NBS to insure proper procedures for sampling, storage, and analysis of biological and environmental type matrices is presented. Protocols established in these procedures will insure that the measurement of an analyte can be made within known and/or required uncertainty levels and that samples can be stored for retrospective analysis. Analytical methods for trace element analysis and techniques for sampling and storage of specific matrices are also included. GRA

N78-27236# School of Aerospace Medicine, Brooks AFB, Tex.
HYDROGEN GAS STANDARDS USING LASER RAMAN SPECTROSCOPY Final Report, Mar. - Apr. 1977
Dwaine M. Thomas Jan. 1978 18 p ref
(AD-A053418; SAM-TR-78-2) Avail: NTIS HC A02/MF A01 CSCL 07/4

The Raman spectra for various concentrations of hydrogen (H2) have been recorded using a multipass gas technique. The intensities were correlated with the concentrations in order to give values which could be used in calibration of H2-detecting instruments. The results indicated the concentration values obtained by Raman were accurate and could be used as another source for standards in calibrating instrumentation. Author (GRA)

N78-27237# Columbia Univ., New York. Dept. of Chemistry.
METAL COMBUSTION PROCESSES AS STUDIED BY CHEMI-LUMINESCENCE AND CHEMI-IONIZATION Final Report, 1 May 1976 - 30 Jun. 1977
Richard N. Zare Feb. 1978 10 p
(Grant DAAG29-76-G-0208)
(AD-A053864; ARO-13785.8-C) Avail: NTIS HC A02/MF A01 CSCL 11/6

Metal combustion processes have been studied (1) by observing and spectroscopically analyzing visible emission; (2) by detecting dark states through their characteristic laser-induced fluorescence; and (3) by determining the nature and type of ionic products produced in some of these highly exothermic reactions. In the course of this work we seek general principals that can tell us about the various ways of disposing of excess reaction energy in the products. Author (GRA)

N78-27238# Utah Univ., Salt Lake City. Dept. of Chemistry.
FOURIER TRANSFORM PHOTOACOUSTIC SPECTROSCOPY
Michael M. Farrow, Roger K. Burnham, and Edward M. Eyring 25 Apr. 1978 13 p refs Submitted for publication
(Contract N00014-75-C-0796; Grants AF-AFOSR-3255-77; NIH-RR-07092; NR Proj. 051-556)

(AD-A053698; TR-15) Avail: NTIS HC A02/MF A01 CSCL 17/8

The feasibility of visible light Fourier transform photoacoustic spectroscopy (FTPAS) is demonstrated. The combined throughput and multiplex advantages of the interferometer significantly reduce the data collection time and/or improve the signal to noise ratio. An FTPAS interferogram and transformed spectrum of neodymium(3) doped glass are reported. Author (GRA)

N78-27239# California Univ., Livermore. Lawrence Livermore Lab.

ABSOLUTE INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS AT LAWRENCE LIVERMORE LABORATORY

R. E. Heft 21 Dec. 1977 15 p refs Presented at the 3d Intern. Conf. on Nucl. Methods in Environ. and Energy Res., Columbia, Mo., 10-13 Oct. 1977

(Contract W-7405-eng-48)

(UCRL-80476; Conf-771072-4) Avail: NTIS HC A02/MF A01

A system of absolute Instrumental Neutron Activation Analysis (INAA) was studied. Basically, absolute INAA is dependent upon the absolute measurement of the disintegration rates of the nuclides produced by neutron capture. From such disintegration rate data, the amount of the target element present in the irradiated sample is calculated by dividing the observed disintegration rate for each nuclide by the expected value for the disintegration rate per microgram of the target element that produced the nuclide. In absolute INAA, the expected value for disintegration rate per microgram is calculated from nuclear parameters and from measured values of both thermal and epithermal neutron fluxes which were present during irradiation. Absolute INAA does not depend on the concurrent irradiation of elemental standards but does depend on the values for thermal and epithermal neutron capture cross-sections for the target nuclides. A description of the analytical method is presented. ERA

N78-27240# Hanford Engineering Development Lab., Richland, Wash.

SEMI-AUTOMATED URANIUM ANALYSIS BY A MODIFIED DAVIES-GRAY PROCEDURE

Gerald C. Swanson 1977 16 p Presented at the Northwest Regional Meeting, Portland, Oreg., 15 Jun. 1977

(Contract EY-76-C-14-2170)

(HEDL-SA-1221; Conf-7706109-1) Avail: NTIS HC A02/MF A01

To rapidly and reliably determine uranium in fuel materials a semi-automated implementation of the Davies-Gray uranium titration was developed. The Davies-Gray method is essentially a three step procedure. First uranium is reduced quantitatively from +6 valence to +4 valence by excess of iron (II) in strong phosphoric acid in the absence of nitrite. Prior to the uranium reduction nitrite is destroyed by addition of sulfamic acid. In the second step iron (II) is selectively oxidized to ion (III) by nitric acid in the presence of Mo (VI) catalyst. Finally after dilution to reduce phosphate concentration, the uranium is titrated to U (VI) by standard dichromate. One of the advantages of the Davies-Gray uranium titration is that it is quite specific for uranium, most common impurity elements do not interfere with the analysis, and specifically high levels of Pu, Th, and Fe are tolerated. ERA

N78-27241# Stanford Research Inst., Menlo Park, Calif.

SULFUR POISONING OF CATALYSTS: A STUDY OF ACTIVITY DECAY IN METHANOL SYNTHESIS AND FISCHER-TROPSCH CATALYSIS Final Report

B. J. Gikis, W. E. Isakson, J. G. McCarty, K. M. Sancier, S. Schechter, P. R. Wentreek, B. J. Wood, and H. Wise 1977 199 p refs

(Contract EY-76-C-02-0060)

(PERC-0060-8) Avail: NTIS HC A09/MF A01

The deactivation of commercial catalysts used for the production of liquid fuels from carbon monoxide and hydrogen was studied with emphasis on sulfidation of methanol synthesis catalysts and carburization of Fischer-Tropsch catalysts. The problem of sulfur poisoning of several commercial high pressure and low pressure catalysts at space velocities and pressures encountered in industrial practice, sulfur segregation and distribution on catalyst surfaces measured by Auger electron spectroscopy and by surface area titration measurements, and the thermodynamics of bulk and surface sulfur in equilibrium with H2 for the copper and iron systems were among the topics studied. The processes of bulk carburization and of surface carbon deposition on promoted iron-based catalysts were also investigated. Thermochemical calculations were made to establish the phase boundary compositions of the stable products in equilibrium with Hagg carbide, cementile, and magnetite. ERA

N78-27242# Georgia Univ., Athens. Dept. of Chemistry.

TRANSITION METAL CHEMISTRY UNDER HIGH CARBON MONOXIDE PRESSURE: AN INFRARED SPECTROSCOPIC STUDY OF CATALYSIS IN THE FISCHER-TROPSCH REACTIONS

R. B. King, A. D. King, Jr., M. Z. Iqbal, C. C. Frazier, and R. M. Hanes Jan. 1978 8 p refs

(Contract EY-76-S-09-0933)

(SRO-933-2) Avail: NTIS HC A02/MF A01

Reactions of Rh compounds with olefins in the presence of CO and H2 were investigated, using the spectraclave; results suggest the formation of aldehydes and Rh(CO)12. Addition of CO to [(CH3)5C5M(CO)2] was found to increase going from M = Cr to Mo and W. HFe(CO)4 was found to be an effective catalyst for the water gas shift reaction (CO + H2O = CO2 + H2) at 140 C and 15 to 30 atm pressure. Other metal carbonyls were screened as catalysts; methanol solutions of M(CO)6(M = Cr, MO, AND W) in the presence of aqueous KOH are active homogeneous catalysts for the water gas shift reaction. ERA

N78-27243# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.

KINETIC AND DEPTH PROFILING APPLICATION OF AUGER ELECTRON AND X-RAY PHOTOELECTRON SPECTROSCOPY

C. P. Lofton and W. E. Swartz, Jr. 20 Feb. 1978 58 p refs

(Contract EY-76-C-04-0656)

(GEPP-355) Avail: NTIS HC A04/MF A01

Auger electron spectroscopic techniques reveal the segregation characteristics of trace impurities in both powder and bulk titanium metal. Segregation of sulfur, carbon, and chlorine in powdered a-titanium occurs via a grain boundary diffusion mechanism with activation energies of 15.5, 6.2 and 9.8 kcal/mol, respectively. The segregation of sulfur and chlorine in arc melted titanium metal occurs via a grain boundary diffusion mechanism with activation energies of 18.7 and 19.7 kcal/mol, respectively. Auger electron and X-ray photoelectron spectroscopic depth profiling techniques of electron beam deposited ultrathin titanium films study the role substrate and deposition temperature play in determination of the chemical composition of the interface. The extent of surface oxidation of thin titanium films increases with increasing deposition temperature, and deposition temperature significantly affects the extent of interaction between the metal and the substrate. ERA

N78-27244# Exxon Research and Engineering Co., Linden, N. J.

SENSITIZED PHOTOELECTROLYSIS OF WATER WITH SUNLIGHT Progress Report, Jun. - 31 Aug. 1977

A. K. Ghosh and H. P. Maruska Sep. 1977 63 p refs

(Contract EG-77-C-02-4271)

(COO-4271-1) Avail: NTIS HC A04/MF A01

The subject of photoelectrolysis of water at illuminated semiconductor electrodes to produce hydrogen is reviewed from 1839 up to the present. 119 literature references are cited. Critical interpretations of important concepts in this area of investigation are given. Techniques for improving the response of cells are discussed, and the expected maximum efficiency is calculated. Additionally, some preliminary experimental results with impurity sensitization of TiO2 electrodes and heterostructure formation are presented. ERA

N78-27245# Brookhaven National Lab., Upton, N. Y.

ELECTRON TRANSFER REACTIONS OF METAL COMPLEXES IN SOLUTION

N. Sutin 1977 30 p refs Presented at Conf. on Tunneling in Biological Systems, Philadelphia, 3 Nov. 1977

(Contract EY-76-C-02-0016)

(BNL-23720; Conf-771150-20) Avail: NTIS

HC A03/MF A01

A few representative electron transfer reactions are selected and their kinetic parameters compared with the predictions of activated complex models. Emphasis is on bimolecular reactions. The latter electron transfer reactions are more complicated to treat theoretically since the geometries of their activated complexes are not as well known as for the intramolecular case. ERA

N78-27246# Dayton Univ. Research Inst., Ohio.
LABORATORY EVALUATION OF HIGH-TEMPERATURE DESTRUCTION OF POLYCHLORINATED BIPHENYLS AND RELATED COMPOUNDS
D. S. Duvall and W. A. Rubey Dec. 1977 73 p refs
(Grant EPA-R-803540)
(PB-279139/0; EPA-600/2-77-228) Avail: NTIS
HC A04/MF A01 CSCL 14B

A specialized laboratory technique incorporating a two-stage quartz system was used for determining the thermal destruction properties of PCB's and related compounds. A small sample was first converted to the gas phase and, then exposed to high-temperature destruction conditions. Critical parameters of temperature and residence time were accurately measured. When PCB's were exposed for one second to a series of high-temperature air environments, initial decomposition occurred at approximately 640 C; greater than 95% molecular destruction was obtained at 740 C; and 99.995% molecular destruction was found at 1000 C. It was determined that PCB's (and certain related compounds) thermally decompose to low molecular weight products, as yet unidentified. GRA

N78-27247# Colorado Univ., Boulder. Dept. of Physics and Astrophysics.
A REPORT ON A NEW MEASUREMENT OF ABSORPTION F SULPHUR DIOXIDE IN THE RANGE 460 cm(-1) TO 560 cm(-1) Final Report
R. A. Bohlander, H. A. Gebbie, R. F. Calfee, and R. L. Schwieson Dec. 1977 18 p refs
(Grant NOAA-04-3-022-24)
(PB-278995/6; NOAA-78021606) Avail: NTIS
HC A02/MF A01 CSCL 07D

The contour of expected absorption of the V2 band of sulphur dioxide in terms of known molecular constants was calculated. Results represent a valuable advance in the spectroscopy of the sulphur dioxide molecule. These are the first quantitative spectra of the V2 band, and the agreement between prediction and observed intensities as shown by the transmission spectrum is gratifying. GRA

N78-27248# Research Triangle Inst., Research Triangle Park, N. C.
EVALUATION OF THE EPA REFERENCE METHOD FOR MEASUREMENT OF NON-METHANE HYDROCARBONS
J. W. Harrison, M. L. Timmons, R. B. Denyszyn, and C. E. Decker Jun. 1977 185 p refs
(Contract EPA-68-02-1800)
(PB-278296/9; EPA-600/4-77-033) Avail: NTIS
HC A09/MF A01 CSCL 14B

A flame ionization detector and gas chromatographic instrument were designed, built, and evaluated to determine the effects of operating parameters on hydrocarbon response and the differences in response to various nonmethane hydrocarbon (NMHC) species. The evaluation included determinations of calibration stability and response to various NMHC species. Calibration stability was found to be reasonable, with span shifts of greater than 5% the biggest problem. There were wide differences in responses to different NMHC species. When ambient air was analyzed there were large discrepancies between analyzer readings which appeared to be related to atmospheric water vapor content. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N78-27249 Princeton Univ., N. J.
PRODUCTION OF MONODISPERSED COPPER CLUSTERS FROM A MULTIPLE EXPANSION CLUSTER SOURCE Ph.D. Thesis
Maurits Philip Taytelbaum 1977 118 p
Avail: Univ. Microfilms Order No. 7807502

A multiple expansion cluster source is used to produce copper clusters with mean radii from 7 to 10 Angstrom. The full width at half maximum of the size distributions of these clusters is 2.6 to 3 Angstrom, corresponding to approximately one monolayer of copper atoms. The physical processes underlying the multiple expansion cluster source are described. The MECS achieves: (1) uniform nucleation or seeding; (2) irreversible condensation of monomer; (3) no diffusion limitation to growth; and (4) a controlled condensation time. A theoretical model, which accurately predicts the final mean size of clusters produced in a MECS, is also presented. Dissert. Abstr.

N78-27250 Colorado State Univ., Fort Collins.
GAS PHASE ION-MOLECULE REACTIONS OF TRANSITION METAL COMPLEXES Ph.D. Thesis
Thomas Vincent Orr 1977 135 p
Avail: Univ. Microfilms Order No. 7807434

The ion-molecule reaction chemistry of several transition metal complexes with small organic and inorganic molecules is discussed. Two types of reactions were studied using the techniques of ion cyclotron resonance spectrometry. Donation, by either substitution or addition, of a negatively charged ligand (Cl(-), F(-), or NO2(-)) from a reagent molecule to a neutral metal complex [Rh2(CO)4C12, Rh(CO)2acac, Mn2(CO)10, or NiC22H22N4] was found to occur selectively. The reactions of ethylene, propylene, and all isomers of butene with ions produced by electron impact on rhodium carbonyl chloride were also studied. Substitution of the olefin for the bridging chloride is found to occur, and a mechanism is proposed to explain the results. Dissert. Abstr.

N78-27251 California Univ., San Diego.
LINEAR RESPONSE THEORY FOR METAL SURFACES Ph.D. Thesis
Peter Wallace Lert 1978 112 p
Avail: Univ. Microfilms Order No. 7808089

The valence electrons in the metal are treated as an electron gas confined at the surface by a model barrier. First, a convenient semiclassical response formalism is introduced and its accuracy is evaluated using the finite barrier model. Results are obtained that agree with the exact quantum mechanical linear response to within ten percent except for short wavelength perturbations. The unphysically strong confinement of the response charge in this model causes a poor description of screening for external perturbations. The semiclassical response formalism is then applied to the model system that employs a step potential surface barrier. This model is a significant improvement over the infinite barrier model as it allows the screening charge to penetrate into the vacuum. The use of linear response theory with pseudopotentials to determine the electronic structure of metal surfaces was also investigated. Dissert. Abstr.

N78-27252 Materials Research Labs., Melbourne (Australia).
THE ELECTRODEPOSITION OF HIGH-PURITY CHROMIUM
L. H. Esmore Mar. 1978 26 p refs
(MRL-R-709; AR-000-885) Copyright. Avail: Issuing Activity

The electro-winning of chromium with a purity of up to 99.99% is described together with significant features of design of a pilot plant. Control of variables and their effects on electro-winning efficiency and quality of the product are reported. Author

N78-27253 Wisconsin Univ., Madison.
FRACTURE AND DESIGN STUDIES OF MALLEABLE AND DUCTILE IRONS Ph.D. Thesis
Yi-Wen Cheng 1977 215 p
Avail: Univ. Microfilms Order No. 7804407

The fracture behavior of malleable and ductile irons was characterized by means of plane strain fracture toughness testing, instrumented dynamic tear testing, conventional mechanical

testing, in addition to metallographic and fractographic examinations of fractured specimens. The materials tested included ferritic malleable iron, two grades of ductile iron, and two grades of pearlitic malleable iron. Test temperatures varied from 70 F to -100 F in the plane strain fracture toughness testing. Dynamic tear testing was performed at various temperatures to determine the ductile-brittle transition curve. The optimization of the pipe coupling design was achieved through stress analysis by means of the finite element method and field testing. Dissert. Abstr.

N78-27254 Case Western Reserve Univ., Cleveland, Ohio.
THERMAL FATIGUE MECHANISMS IN ALUMINUM DIE CASTING DIE STEELS Ph.D. Thesis
Roland Ralph Graham 1978 150 p
Avail: Univ. Microfilms Order No. 7809282

The mechanisms of thermal fatigue initiation and propagation are studied on internally water cooled specimens alternately immersed in molten aluminum and cooled in air. Two types of die steel with various preparatory heat treatments are studied in detail. Determination of the mechanisms of crack initiation and propagation in H-13 tool steel hardened from temperatures varying from 1850 F to 2200 F and in 300 maraging steel aged at temperatures from 950 F to 1050 F are made. Metallurgical properties and changes are studied metallographically using optical and electron microscope examination and with the microprobe. Temperature and stress cycles are determined using finite element techniques to match measured temperature response. The stress cycle results are used to calculate cyclic crack tip stress intensity values. Dissert. Abstr.

N78-27255*# National Aeronautics and Space Administration. Pasadena Office, Calif.
A METHOD OF PREPURIFYING METALLURGICAL GRADE SILICON EMPLOYING REDUCED PRESSURE ATMOSPHERIC CONTROL Patent Application
William M. Ingle (Motorola, Inc., Phoenix, Ariz.), Stephen W. Thompson (Motorola, Inc., Phoenix, Ariz.), and Robert E. Chaney, inventors (to NASA) (Motorola, Inc., Phoenix, Ariz.) Filed 23 Jun. 1978 10 p
(Contracts NAS7-100; JPL-95442)
(NASA-Case-NPO-14474-1; US-Patent-Appl-SN-918537) Avail: NTIS HC A02/MF A01 CSCL 11F

A process for use in purification of metallurgical grade silicon was studied. A quartz tube is charged with chunks of metallurgical grade silicon, and/or a mixture of such chunks and high purity quartz sand. Impurities from a class of metals including aluminum, and boron as well as certain transition metals such as nickel, iron as, and manganese are also included. The tube is heated and evacuated to a temperature within a range of 800 C to 1350 C. A stream of gas comprising a reactant such as silicon tetrafluoride, continuously is delivered at low pressures through the charge for causing a metathetical reaction of impurities of the silicon and the reactant to occur for forming a volatile halide and leaving a residue of silicon of improved purity. The reactant may include carbon monoxide gas, whereby impurities such as iron and nickel are permitted to react to form volatile carbonyls. NASA

N78-27256*# Kaiser Aluminum and Chemical Corp., Oakland, Calif.
FLAT GROWTH OF 7075, 7475, 7050 AND 7049 ALUMINUM ALLOY PLATE IN STRESS CORROSION ENVIRONMENTS: 2-YEAR MARINE ATMOSPHERE RESULTS
R. C. Dorward and K. R. Hasse 22 Jun. 1978 57 p refs
(Contract NAS8-30890)
(NASA-CR-150737; CFT-RR-78-16) Avail: NTIS HC A04/MF A01 CSCL 11F

Marine atmospheric exposure of smooth and precracked specimens from 7075, 7475, 7050 and 7049 plates support the conclusion that for a given strength level, the short transverse stress corrosion resistance of 7050-T7X and 7049-T7X is superior to that of 7075-T7X. The threshold stress intensity (K sub Iscc) for these alloys is about 25 MPa square root m at a yield strength of about 460 MPa; the corresponding yield strength level for 7075-T7X at this SCR level is about 425 MPa. Additional tests on two lots of high-toughness 7475 plate indicate that this alloy is capable of achieving K sub Iscc values of about 35 MPa square root m at yield strengths of 400-450 MPa. Precracked specimens from all these 7XXX-series alloys are subject to self loading from corrosion product wedging. This effect causes stress corrosion cracks to continue growing at very low apparent stress intensities, and should therefore be considered a potential driving force for stress corrosion in design and materials selection. L.S.

N78-27257*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE USE OF ION BEAM CLEANING TO OBTAIN HIGH QUALITY COLD WELDS WITH MINIMAL DEFORMATION
Bernard Sater and Thomas J. Moore 1978 13 p refs Presented at 10th Natl. Technical Conf., N. Y., 17-19 Oct. 1978; sponsored by Soc. for the Advancement of Material and Process Engineering
(NASA-TM-78933; E-9676) Avail: NTIS HC A02/MF A01 CSCL 11F

A variation of cold welding is described which utilizes an ion beam to clean mating surfaces prior to joining in a vacuum environment. High quality solid state welds were produced with minimal deformation. L.S.

N78-27258# Bureau of Mines, Rolla, Mo. Metallurgy Research Center.
FACTORS AFFECTING FABRICABILITY OF ELECTROWON COPPER
J. L. Holman, J. F. McLlwain, and L. A. Neumeier 1978 54 p refs
(PB-277926/2; BM-RI-8261) Avail: NTIS HC A04/MF A01 CSCL 11F

The Federal Bureau of Mines has conducted research to delineate factors affecting relative fabricability of electrowon and electrorefined copper. A statistical round-robin chemical analysis was coordinated and impact tests on lead doped copper specimens were performed. In a series of round-robin analyses, cathode, bar, or rod from a domestic lot of electrorefined copper and electrowon copper from a domestic and a Peruvian source were analyzed for Pb, Fe, Bi, Se, Ag, O, S, Sb, and seven other elements. The electrowon cathode from both sources surpassed requirements for electrolytic cathode, although lead in the Peruvian lot exceeded specification for oxygen free electronic grade. GRA

N78-27259# Bureau of Mines, Washington, D. C.
COLUMBIUM
Henry E. Stipp Jan. 1978 18 p Supersedes BM-B-667, PB-266089
(PB-278579/8; BM-MCP-10) Avail: NTIS HC A02/MF A01 CSCL 08I

A comprehensive description and analysis of the columbium industry from mining through preparation and use of primary and intermediate forms of columbium as metal, alloy, carbide, and oxide are presented. Included is information on some of the following: industry structure, size, organization, and geographic distribution; definitions, grades, and specification. GRA

N78-27260# International Nickel Co., Inc., Suffern, N. Y. High Temperature Materials Section.
QUARTERNARY AND HIGHER VOLUMES ALLOY ADDITIONS TO OXIDE DISPERSION STRENGTHENED HIGH VOLUME FRACTION GAMMA PRIME Ni-Cr-Al ALLOYS MADE BY MECHANICAL ALLOYING Final Report, Nov. 1976 - Dec. 1977
R. C. Benn Dec. 1977 80 p refs
(Contract N62269-76-C-0483)
(AD-A053779; NADC-76204-30) Avail: NTIS HC A05/MF A01 CSCL 11/6

The object of this work was to develop ODS alloys which would derive a significant high temperature strength increment from the retention of high volume fractions (=50%) of gamma at 2000 F(1095 C). This investigation has identified the nature and level of quaternary addition elements that are beneficial to the directional recrystallization response and properties of ODS, high volume fraction gamma, Ni-Cr-Al alloys made by mechanical alloying. Specifically, the effects of quaternary additions of W, Ta, Nb, Mo, Co, Hf and Ti were investigated. In particular, the quaternary alloys with W and Mo respectively exhibited significant high temperature strength advantages over DS Mar

M-200 + Hf and a current DS gamma/gamma-alpha eutectic. Raising the CR level in the ternary Ni-Cr-Al base alloy significantly improved the corrosion resistance. Oxidation resistance of the experimental alloys was excellent. The data from the simple ternary and quaternary alloys was used to initiate a program of designing more complex alloys. GRA

N78-27261# Naval Postgraduate School, Monterey, Calif.
EFFECTS OF THERMOMECHANICAL PROCESSING ON DAMPING CHARACTERISTICS OF MARTENSITIC Cu-13.5 w/o Al ALLOY FOR SHIP SILENCING APPLICATION M.S. Thesis
Edward William Kelly Dec. 1977 59 p refs
(AD-A053878) Avail: NTIS HC A04/MF A01 CSCL 11/6

Cu-Al alloys demonstrate high damping capacity in the martensitic state. The specific damping capacity in the gamma: martensite of a Cu-13.5 w/o Al alloy was found to vary with grain size. Since platelet length increased with grain size while platelet width remained relatively invariant, it can be inferred that martensitic platelet motion was an active mechanism for damping. Several thermomechanical processes were explored to establish positive grain size control. It was found that grain nucleation and recrystallization and grain growth were very sensitive to the usual parameters of prior strain, strain rate, annealing temperature and annealing time. Severe brittleness, reversible shape memory effects, and pseudo-elasticity were encountered during the process experimentation. Author (GRA)

N78-27262# Stanford Univ., Calif. Dept. of Materials Science and Engineering.
FINE STRUCTURE AND SUPERPLASTICITY IN ULTRAHIGH CARBON STEELS Annual Progress Report, 1 Jan. - 31 Dec. 1977
J. Wadsworth, J. T. Lo, B. Walser, R. Caligiuri, and O. D. Sherby 31 Dec. 1977 69 p refs
(Contract N00014-77-C-0149)
(AD-A053571; APR-1) Avail: NTIS HC A04/MF A01 CSCL 11/6

This program has centered on the thermal-mechanical processing of steels containing 1 to 2.3%C and their properties. These ultrahigh carbon (UHC) steels have been commercially neglected because of a traditional belief that they are brittle. The processing however leads to the formation of extremely fine cementite particles of about 1/10 micron (0.0001 mm) in a matrix of extremely fine ferrite grains of about 1 micron (0.001 mm) or less. This fine structure lends itself to several unique and exciting characteristics which revolutionize the traditional attitudes to these materials. In the first place these fine grained steels are superplastic at warm temperatures and elongations to failure of over 1500% have now been obtained. This means that these materials can be very easily formed. Second, they are strong and ductile at room temperature and the strength can be simply controlled by the final processing temperature or subsequent heat treatment. Third, they can be given a simple transformation heat treatment to form a structure of cementite and martensite which is about as hard as tungsten carbide.GRA

N78-27263# Sandia Labs., Albuquerque, N. Mex.
DETERMINATION OF CORROSION PARAMETERS BY DIGITAL IMPEDANCE ANALYSIS
William H. Smyrl and Steven L. Pohlman 1978 15 p refs Presented at NACE Meeting on Corrosion, Houston, Tex., 6 Mar. 1978
(Contract EY-76-C-04-0789)
(SAND-78-0038C; Conf-780308-1) Avail: NTIS HC A02/MF A01

A digital signal analysis system which has been used to determine the impedance of electrochemical cells with corroding electrodes is described. The measurement system is based on a Hewlett Packard 9830 Calculator which controls data acquisition on a recorder and stores the two channels of digital data on cassette tapes. The data are routinely transmitted, analyzed, and plotted on a time-share CDC 6600 system. Application of the system to dummy cells which simulate the behavior of an electrode revealed that quite accurate results may be obtained for idealized systems. ERA

N78-27264# Battelle Pacific Northwest Labs., Richland, Wash.
CORROSION OF IRON-BASE ALLOYS VERSUS ALTERNATE MATERIALS IN GEOTHERMAL BRINES Interim Report, period ending Oct. 1977
D. W. Shannon Nov. 1977 37 p refs
(Contract EY-76-C-06-1830)
(PNL-2456) Avail: NTIS HC A03/MF A01

A series of 30 refreshed autoclave tests and one field test were performed to define how various chemical components in geothermal brines affect uniform corrosion of 35 materials. The data indicate uniform corrosion rates of carbon steels are satisfactory for most major components of a geothermal power plant for low salinity neutral to alkaline pH reservoirs, when 20 miles per year corrosion allowances are permitted. While some minor alloy effects were observed among the 10 carbon steels tested, the alloy composition of the carbon steel was a second order effect compared with important brine chemistry variables such as pH, salinity, and temperature. The corrosion rates of carbon steels were found to be largely controlled by the composition and structure of the corrosion product film that formed on the metal. A number of alloys were found in the scrrening tests that showed negligible corrosion under all conditions tested up to 250 C and 22 percent salimities. Alternate materials to carbon steels are listed. ERA

N78-27265# United Nuclear Industries, Inc., Richland, Wash.
EFFECTS OF UPSETTING ON THE PHYSICAL PROPERTIES OF ZIRCALOY PRESSURE TUBES
W. K. Alexander 27 Dec. 1977 13 p refs
(Contract EY-76-C-06-1857)
(UNI-894) Avail: NTIS HC A02/MF A01

A method for restoring N reactor pressure tubes to their original length by heating and upsetting was developed and demonstrated on reactor. The technique can be used to relieve keypacking and connector interference. The heating and upsetting will produce some changes in the physical properties and corrosion resistance of the tubes in the areas so treated. A program to investigate these changes on sections of tubing in the laboratory was carried out before a reactor demonstration was approved. ERA

N78-27266# National Technical Information Service, Springfield, Va.
METAL DRAWING. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Mar. 1978
William E. Reed Apr. 1978 103 p Supersedes NTIS/PS-77/0343, NTIS/PS-76/0355, and NTIS/PS-75/162
(NTIS/PS-78/0370/3; NTIS/PS-77/0343; NTIS/PS-76/0355; NTIS/PS-75/162) Avail: NTIS CSCL 13H

Citations include application of ultrasonic energy, effects of friction, lubricants and lubrication, and deformation. (This updated bibliography contains 98 abstracts, 22 of which are new entries to the previous edition.) GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N78-27267 Lehigh Univ., Bethlehem, Pa.
RHEOLOGICAL BEHAVIOR OF HIGH RESIN-LEVEL PLASTISOLS Ph.D. Thesis
Gary Edward Williams 1977 107 p
Avail: Univ. Microfilms Order No. 7808082

Different particle-size cuts from 1730 dispersion-grade-poly (vinyl chioride) resin and di-2-ethylhexyl phthalate (DOP), n-butyl benzyl phthalate (BBP), and di-2-ethylhexyl adipate (DOA) plasticizers were used to prepare plastisols, varying in volume fraction of resin from 0.567 to 0.670. In the range of concentrations studied, both shear-thickning and shear-thinning behavior was observed at a critical shear rate. This viscosity discontinuity depends strongly on the particle-size characteristics of the resin, and the compatibility of the plasticizer with the resin.
Dissert. Abstr.

N78-27268 Princeton Univ., N. J.
RAPID PYROLYSIS OF UNTREATED AND FLAME RETARDANT TREATED POLYMERS Ph.D. Thesis
Robert Shi-Hsiung Wang 1978 230 p
Avail: Univ. Microfilms Order No. 7807506

A pyrolysis-gas chromatographic technique was developed to provide control temperature, heating rate, heating time, and atmosphere for the quantitative analysis of 12 volatile products from the pyrolysis of polyethylene terephthalate (PET). Attention was focused on pure PET, flame retardant treated PET, and PET blended with cotton fibers in order to ascertain the possible causes of some unexpected ignition behavior of polymers. The treatment of PET with diammonium phosphate makes the polymer ignite faster at a given temperature than the untreated polymer PET and PET/cotton blends ignite faster than the individual component polymers. The possible connection between the results of autoignition and rapid pyrolysis experiments is examined.
Dissert. Abstr.

N78-27269 Florida State Univ., Tallahassee.
A LINEAR RESPONSE FORMULATION OF THE CIRCULAR DICHROISM OF HELICAL POLYMER RODS Ph.D. Thesis
Stephen Maurice Redmann, Jr. 1977 96 p
Avail: Univ. Microfilms Order No. 7808966

The optical properties of extended polymers of helical symmetry are expressed in terms of elements of the linear response tensor (LRT). Because of helical symmetry and the related exciton selection rules for periodic boundary conditions, the orientationally averaged circular dichroism (CD) for a solution of such polymers is given solely in terms of the LRT for light propagation parallel to the polymer axis. The various contributions to the CD are separated into three terms in this formulation-the helix term, the radial term, and the residue term. The circular dichroism of polyadenylic acid (poly A), a single-stranded synthetic polynucleotide, is calculated for three distinct polymer geometries. The high energy region of the spectrum, between 200 and 240 nm, is most sensitive to configuration of the polymer. Dissert. Abstr.

N78-27270 Case Western Reserve Univ., Cleveland, Ohio.
STRUCTURE AND PROPERTIES OF POLYDIMETHYLSILOXANE DIZWITTERIONOMERS COPOLYMERS Ph.D. Thesis
Daniel Graiver 1978 192 p
Avail: Univ. Microfilms Order No. 7809283

Small angle X-ray and electron microscopy were used to study the morphology of these polymers. As in order poly-electrolytes, the zwitterions aggregate into ionic domains. In this case the domains are lamellar in nature and are in parallel arrays. The distance between these ionic regions is inversely proportional to the dizwitterion concentration in the polymer; their thickness is independent of the ionic concentration and is about 7A-A. The interaction of water with the various polysiloxane dizwitterionomers and the model compound DHTS 4,7-DPS was studied. The model compound is soluble in water while the polymers swell inhomogeneously when soaked in water. The initial sorption kinetics of these zwitterionomers indicate similar mechanism of water uptake independent of ion concentration. Dissert. Abstr.

N78-27271 North Dakota State Univ., Fargo.
RHEOLOGY OF WATER SOLUBLE ACRYLICS; DILUTION BEHAVIOR AND EFFECT OF SOLVENT LOSS ON APPLICATION PROPERTIES Ph.D. Thesis
Larry Bruce Brandenburger 1977 117 p
Avail: Univ. Microfilms Order No. 7808311

The relationship between molecular properties or dimensions of water soluble polymers and rheological properties was elucidated. Viscosity variations during dilution with several constant n-propoxypropanol percentages in water were determined for acrylic polymers and for three surfactants, sodium dodecyl sulfate, polyoxyethylene (23) dodecyl ether, and dodecanoic acid (100% neutralized with 2 dimethyl amino ethanol). A comparison of the shape of the dilution curves shows many similarities which can be accounted for by assuming the polymers, as well as the surfactants, exhibit micellar or aggregation behavior. Paints were prepared and sprayed with an automatic spraying apparatus at varying relative humidities, and the sagging and leveling behavior were noted. Analytical results were used to prepare a solvent loss model which predicts the level of water and cosolvent remaining in the paint film as a function of time, relative humidity, film thickness and starting concentration of water and cosolvent. Dissert. Abstr.

N78-27272*# Bowie State Coll., Md. Office of Federal Programs.
CHARACTERIZATION OF THE PHYSICO-CHEMICAL PROPERTIES OF POLYMERIC MATERIALS FOR AEROSPACE FLIGHT Semiannual Report
Michael Rock 20 Jul. 1978 9 p
(Grant NsG-5009)
(NASA-CR-156935) Avail: NTIS HC A02/MF A01 CSCL 07C

Materials intended for use in spacecraft are routinely tested at low pressures, and outgassed substances are condensed on cold surfaces at liquid nitrogen temperature, -196 C. These condensates are then analyzed by infrared spectroscopy, and gas chromotography-mass spectroscopy. The polymers were tested and allowed to outgas isothermally at 125 C and 0.000001 torr or less. Valuable information was obtained by extending the temperature range below and above 125 C. The performance of substances of interest to NASA were investigated by thermogravimetric analysis (TGA) from room temperature to 450 C or until the substance decomposed. Thermogravimetric analysis of a substance is a useful technique for studying its thermal nature in both static and dynamic thermal environments. It gives considerable insight into the stability and characterization of substances and the changes they undergo in varying thermal environments. The system is able to get pressures down to 1 micron or 0.001 torr. G.Y.

N78-27273*# Du Pont de Nemours (E. I.) and Co., Wilmington, Del.
NR-150B2 ADHESIVE DEVELOPMENT Final Report, 16 Sep. 1976 - 16 Nov. 1977
P. S. Blatz Washington NASA Jul. 1978 121 p refs
(Contract NAS1-14620)
(NASA-CR-3017) Avail: NTIS HC A06/MF A01 CSCL 11A

Adhesive based polyimide solutions which are more easily processed than conventional aromatic polyimide systems and show potential for use for extended times at 589K are discussed. The adhesive system is based on a solution containing diglyme as the solvent and 2,2 bis(3',4'-dicarboxyphenyl)hexafluoropropane, paraphenylenediamine, and oxydianiline. The replacement of N-methylpyrrolidone with diglyme as the solvent was found to improve the adhesive strengths of lap shear samples and simplify the processing conditions for bonding both titanium and graphite fiber/polyimide matrix resin composites. Information was obtained on the effects of various environments including high humidity, immersion in jet fuel and methylethylketone on aluminum filled adhesive bonds. The adhesive was also evaluated in wide area bonds and flatwise tensile specimens using titanium honeycomb and composite face sheets. It was indicated that the developed adhesive system has the potential for use in applications requiring long term exposure to at least 589K (600 F). B.B.

N78-27274*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF PRESSURE AND TEMPERATURE ON HOT PRESSING A SIALON
Hun C. Yeh 1977 18 p refs Presented at the Fall Meeting of the Basic Sci. Div. of the Am. Ceram. Soc., Hyannis, Mass., 25-28 Sep. 1977
(NASA-TM-78945; E-9692) Avail: NTIS HC A02/MF A01 CSCL 11D

Mixed powders (60 m/o Al2O3-40 m/o Si3N4) were hot pressed at temperatures and pressures from 1360 to 1750 C and 3.5 to 27.5 MPa (0.5 to 4.0 ksi). Fully dense sialon bodies are obtainable at temperatures and pressures as low as 1550 C and 0.5 ksi. The fully dense bodies contain Beta prime and x-phase. There is some evidence that plastic deformation has contributed to densification. Author

N78-27275*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CHELATE-MODIFIED POLYMERS FOR ATMOSPHERIC GAS CHROMATOGRAPHY Patent Application
Warren W. Christensen, Ludwig A. Mayer (San Jose State Univ.,

Calif.), and Fritz H. Woeller, inventors (to NASA) (San Jose State Univ., Calif.) Filed 30 Jun. 1978 20 p Sponsored by NASA (NASA-Case-ARC-11154-1; US-Patent-Appl-SN-921626) Avail: NTIS HC A02/MF A01 CSCL 07D

New polymeric materials were developed to serve as the stationary phase in chromatographic columns. These materials consist of a crosslinked polymer matrix, e.g., a divinylbenzene polymer, into which was embedded an inorganic complexed ion or chelate, e.g., Co(acacen), which is N,N'-ethylene-bis (acetylacetoniminato)cobalt (2). Organic nitrogenous bases, such as pyridine, may be incorporated into the chelate-polymer complexes to increase their chromatographic utility. Critical factors in obtaining satisfactory chromatographic performance from the polymer-chelate complexes are identified as: (1) the nature and concentration of the nonpolar diluent, n-heptane and ethylbenzene being preferred, (2) completeness of crosslinking of the matrix, (3) the chelate content of the complex, and (4) the nature and concentration of the coordinating organic base employed. NASA

N78-27276# Research Triangle Inst., Research Triangle Park, N. C.
A STUDY OF GLOW DISCHARGE POLYMERIZATION AS A MEANS OF MODIFYING THE SURFACE OF POLYMERS Annual Report, 1 Dec. 1976 - 30 Nov. 1977
H. Yasuda, N. Morosoff, and T. Hirotsu Nov. 1977 111 p refs
(Contract N01-HV-3-2913)
(PB-278122/7; NIH-N01-HV-3-2913-5) Avail: NTIS HC A06/MF A01 CSCL 07C

Factors involved in progress of glow discharge polymerization of organic compounds were examined. An overall view of glow discharge polymerization was obtained so that blood compatible surfaces can be prepared in a consistent manner, and by different reactors designed to coat surfaces of substrates in various sizes and shapes. Glow discharge polymer of tetramethyldisiloxane was found not only to withstand a severe flexing but also to impart an excellent flex resistant protection to the substrate material. GRA

N78-27277# Ceramic Finishing Co., State College, Pa.
FRAGMENT FORMATION AND DAMAGE PENETRATION DURING MACHINING OF CERAMICS
Henry P. Kirchner, Robert M. Gruver, and Dominique Richard Mar. 1978 69 p refs
(Contract NSF C-APR-77-19818)
(PB-278709/1) Avail: NTIS HC A04/MF A01 CSCL 11B

Abrasive machining includes grit blasting, free abrasive machining, single point grinding and other processes, as well as multipoint grinding. The principal approach is to apply the techniques and theory of indentation fracture mechanics which were developed recently in investigations of static indentations and particle impact, to the study of abrasive machining. Specimens of glass and hot pressed silicon nitride were damaged by controlled scratching and single point diamond grinding. Vertical and horizontal forces acting on the material were measured for various diamond shapes, set depths and wheel speeds. The damage was characterized by optical and scanning electron microscopy. GRA

N78-27278# Naval Research Lab., Washington, D. C. Combustion and Fuel Branch.
ELECTROSTATIC CHARGING OF JP-4 FUEL ON POLYURETHANE FOAMS Final Report
Joseph T. Leonard and Wilbur A. Affens Mar. 1978 20 p refs Sponsored by the Dept. of the Air Force
(AD-A053831; AD-E000148; NRL-8204) Avail: NTIS HC A02/MF A01 CSCL 20/3

The electrostatic charge generating characteristics of JP-4 fuel were determined on both polyester and polyether-type polyurethane foams. Eleven samples of JP-4 fuel, covering a range in electrical conductivity of 0.65 to 10.27 picosiemens/m (pS/m) were tested. The conductivity of one sample was increased incrementally to 200 pS/m by use of a static dissipator additive (ASA-3). The charging tendency of the fuels was determined by measuring the filter current developed by the passage of 50 ml of fuel through a cylindrical section of foam held in an electrically isolated filter holder. The charging tendencies of all fuel samples were also determined using a reference paper filter. It was found that JP-4 fuels can become charged electrostatically by flowing through polyurethane foam. However, the magnitude of the charge cannot be predicted from the electrical conductivity of the fuel nor on the basis of its charging tendency on the reference paper filter. The charging tendencies on the polyether foams were about six times greater than on the polyester foams. Author (GRA)

N78-27279# AiResearch Mfg. Co., Phoenix, Ariz.
CERAMIC TECHNOLOGY READINESS PROGRAM Monthly Technical Progress Report, 28 Nov. 1977 - 1 Jan. 1978
16 Jan. 1978 27 p refs
(Contract EF-77-C-01-2664)
(FE-2664-3; MTPR-3) Avail: NTIS HC A03/MF A01

Evidence of the ability of ceramic components to survive for lifetimes adequate for utility application in an environment of high temperature combustion products from coal derived fuels was provided. Technology readiness for the application of ceramic materials technology to advanced gas turbines operating on coal derived fuel in utility base load and intermediate load service was developed and demonstrated. A supply of basic ceramic powders for use in noncommercial investigations of materials properties, fabrication techniques, and test methods was ensured. ERA

N78-27280# National Bureau of Standards, Washington, D. C. Institute for Materials Research.
THE EFFECTS OF TEMPERATURE AND MOISTURE ON THE ACCELERATED AGING OF PAPER Progress Report, Jul. 1975 - Dec. 1976
E. L. Graminski, E. J. Parks, and E. E. Toth Mar. 1978 75 p refs Sponsored in part by National Archives and Records Service, Washington, D. C.
(PB-279046/7; NBSIR-78-1443) Avail: NTIS HC A04/MF A01 CSCL 11L

The rate of paper degradation at elevated temperatures appeared to be directly proportional to the partial pressure of atmospheric water up to 50% relative humidity. This linear relationship continued to exist at higher humidities at 60 C but not at 80 C. It is uncertain at this time whether the water in question is bound to cellulose or is atmospheric moisture. Additional degradation studies at relative humidities above 50% must be conducted in order to identify the type of water affecting the degradation rate. There is also an indication that either an optimum temperature exists for accelerated aging of paper or that the cellulose-water interaction at the higher temperatures and lower humidities differs significantly from that at ambient temperatures. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N78-27281 Materials Research Labs., Melbourne (Australia).
THERMAL DECOMPOSITION OF TETRAZINE AT 90 C
R. Bird and A. J. Power Mar. 1978 19 p refs
(MRL-R-710; AR-000-886) Copyright. Avail: Issuing Activity

The stab-sensitizing explosive tetrazene converts substantially to 5-aminotetrazole at 90 C. Spectroscopic evidence indicated that this product derived from both the side chain (via guanyl azide) and the tetrazole ring. The total volume of gaseous products liberated by this reaction was also measured. G.G.

N78-27282# United Technologies Corp., Sunnyvale, Calif. Chemical Systems Div.
THE 84-INCH PROPELLANT CARTRIDGES AND GRAINS. VOLUME 3: APPENDIX Final Report, Nov. 1975 - Nov. 1977
Terry V. OHara, Wendell A. Stephen, and Joe B. Henry 30 Nov. 1977 293 p refs
(Contract F04611-76-C-0010)
(AD-A051133; CSD-2579-FR-Vol-3; AFRPL-TR-77-92-Vol-3)

Avail: NTIS HC A13/MF A01 CSCL 21/8

This document reports the results obtained from casting a total of 30 84 inch cartridges with UTP-18,803A propellant (90% solids, 21% aluminum, HTPB). Both ballistic and mechanical property data obtained during the production of over 730,000 lbs of propellant is presented. Documentation for propellant production is provided. Author (GRA)

N78-27283# California Univ., Livermore. Lawrence Livermore Lab.

PROPERTIES OF BENZOTRIFUROXAN

R. R. McGuire 27 Oct. 1977 28 p refs

(Contract W-7405-eng-48)

(UCRL-52353) Avail: NTIS HC A03/MF A01

Benzotrifuroxan (BTF) is a CO-balanced, hydrogen-free explosive that is sensitive to exploding bridgewire initiation. It has performance parameters equivalent to those of HMX-based explosives, but with a different isentrope. BTF is a chemically reactive material that forms compounds with electron-donating substrates. The procedures normally used to prepare BTF result in low levels of trinitrotriazidbenzene that degrade its already limited thermal stability. However, BTF can be purified by recrystallization and can then be safely handled. ERA

N78-27284# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex.

PERFORMANCE AND SENSITIVITY TESTING OF TATB Progress Report, Jul. - Sep. 1977

P. E. Kramer 1977 5 p

(Contract EY-76-C-04-0487)

(MHSMP-77-52) Avail: NTIS HC A02/MF A01

Gap testing of the LLL thermally conditioned specimens of RX-03-BB, Blend 2 continued with 4 groups being tested. Thus far, it has been possible to predict results fairly accurately by considering only the final density of the samples. Tests conducted on TATB aminated by an emulsion process raised questions about the correlation between density and sensitivity. ERA

N78-27285# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex.

EVALUATION OF KRATON GX-6500 AS A BINDER MATERIAL

H. D. Johnson, A. Gordon Osborn, Thomas L. Stallings, and Jack R. Anthony Sep. 1977 9 p

(Contract EY-76-C-04-0487)

(MHSMP-77-54) Avail: NTIS HC A02/MF A01

A 23 kilogram batch of a 95 percent HMX/5 percent Kraton GX-6500 PBX formulation was made and subjected to routine safety evaluation and preliminary physical properties screening. No unusual reactivity was seen; drop hammer sensitivity is similar to LX-10. Diametric disc test parts, pressed to about 98 percent of TMD at 281 MPa/120 C, indicate that the PBX strength lies between LX-04-1 and LX-09. ERA

N78-27286# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex.

LOW-INDUCTANCE CAPACITOR DISCHARGE SYSTEM

Elisha L. Demerson Nov. 1977 9 p Prepared for Sandia Labs., Albuquerque, N. Mex.

(Contract EY-76-C-04-0487)

(MHSMP-77-61) Avail: NTIS HC A02/MF A01

The components of a low inductance capacitor discharge system to be used to initiate slapper detonators are described and the preliminary calibration measurements and flyer velocities obtained from tests using the TC 817 device are given. ERA

N78-27287# Department of Energy, Bartlesville, Okla. Energy Research Center.

MOTOR GASOLINES, SUMMER 1977

E. M. Shelton Jan. 1978 92 p refs

(BERC/PPS-78/1) Avail: NTIS HC A05/MF A01

Analytical data for 2,725 samples of motor gasoline, from service stations throughout the country, were collected and analyzed. The samples represent the products of 49 companies, large and small, which manufacture and supply gasoline. These data are tabulated by groups according to brands (unlabeled) and grades for 17 marketing areas and districts into which the country is divided. A map shows marketing areas, districts, and sampling locations. Charts indicating the trends of selected properties of motor fuels since 1946 are included. Twelve octane-distribution-percent charts for areas 1, 2, 3, and 4 for unleaded, regular, and premium grades of gasoline are presented. The antiknock (octane) index [(R + M)/2] averages of gasolines sold in this country were 88.5, 89.6 and 95.0 for unleaded, regular, and premium grades of gasolines, respectively. ERA

N78-27288# California Univ., Berkeley. Lawrence Berkeley Lab.

HYDROGENATION OF CO AND CO2 ON CLEAN RHODIUM AND IRON FOILS. CORRELATIONS OF REACTIVITIES AND SURFACE COMPOSITIONS

D. Dwyer, K. Yoshida, and G. A. Somorjai 16 Dec. 1977 40 p refs Presented at Div. of Fuel Chemistry Meeting, Anaheim, Calif., 12 Mar. 1978

(Contract W-7405-eng-48)

(LBL-6989; Conf-780305-12) Avail: NTIS HC A03/MF A01

An experimental arrangement consisting of an ultrahigh vacuum (UHV) bell jar equipped with an internal sample isolation cell was used to investigate the hydrogenation of CO over Fe and Rh surfaces. This apparatus permitted both UHV surface characterization (Auger electron spectroscopy, low-energy electron diffraction) and high pressure catalytic reactions to be carried out. Small surface area metal samples, both single crystals and polycrystalline foils, were used to catalyze the H2/CO reaction at high pressures. Reaction products were monitored with a gas chromatograph equipped with a flame ionization detector. The surface compositions of the metal samples were determined before and after the reaction and the results correlated with the observed product distributions and reaction rates were also investigated. ERA

N78-27289# Mobil Research and Development Corp., Paulsboro, N. J.

DEVELOPMENT STUDIES ON SELECTED CONVERSION OF SYNTHESIS GAS FROM COAL TO HIGH OCTANE GASOLINE

Mar. 1978 37 p refs

(Contract EX-76-C-01-2276)

(FE-2276-20) Avail: NTIS HC A03/MF A01

Aging and regeneration studies of developmental catalysts SG-B-3 and SG-A-4 in the micro reactor units (10 cc catalyst capacity). Hydrogen regeneration of SG-B-3 at 700 F restores catalyst selectivity, however, catalyst activity is not completely restored by this treatment. High temperature oxidative regneration of catalyst SG-A-4 was successful. Multiple regeneration studies are now being made. Aging data was obtained on five catalysts in the direct conversion of synthesis gas to dimethylether. All catalysts showed significant aging when compared with proven methanol synthesis catalysts. Flow studies with a spent catalyst in the plexiglass model indicate that slugging may occur in the bench-scale fluid unit (150 cc catalyst capacity). Catalysts recovered from the unit show that carbon formation is excessive and probably responsible for the slugging and the uncontrollable higher tempeatures observed in the catalyst disengager zone. ERA

N78-27290# Southwest Research Inst., San Antonio, Tex.

EMISSION AND FUEL ECONOMY SENSITIVITY TO CHANGES IN LIGHT DUTY VEHICLE TEST, TASK 10 PROCEDURES Final Report, Aug. 1976 - Apr. 1977

Robert L. Srubar May 1977 252 p

(Contract EPA-68-03-2196)

(PB-277343/0; EPA-460/3-77-024) Avail: NTIS HC A12/MF A01 CSCL 21D

Five light duty vehicles and projected vehicle populations and emission control systems were used to investigate emission and fuel economy sensitivity to changes in current test procedures for light duty vehicles. The length of soak period preceding the EPA Urban Dynamometer Driving Schedule (UDDS), and the speed versus time characteristics of the UDDS and EPA Highway Fuel Economy Test (FET) were varied. A test was used to test for significant differences between baseline results and results obtained with modified driving cycles. Means, standard deviations, and coefficients of variation were calculated for groups of tests for each particular vehicle at each test condition. GRA

N78-27059*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMPACT OF BROAD-SPECIFICATION FUELS ON FUTURE JET AIRCRAFT
Jack Grobman *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 Jun. 1978 p 217-233 refs (For primary document see N78-27046 18-01)
Avail: NTIS HC A22/MF A01 CSCL 21D

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N78-27291 Texas Univ. at Austin.
THE DESIGN AND BEHAVIOR OF BEAM-COLUMNS IN UNBRACED STEEL FRAMES Ph.D. Thesis
Tokul Kanchanalai 1977 320 p
Avail: Univ. Microfilms Order No. 78-07329

Theoretical studies were conducted to determine the strength of the beam-columns in symmetrical portal frames and frames containing some columns with pinned connections (leaned frames). The variables in the studies were the slenderness ratio, the relative column-to-beam stiffness, the effect of bending axis, the effect of the residual stress, and the effect of axial load on the pinned-end column in leaned frames. Exact interaction curves were developed for these cases. The results obtained were used as the basis for the comparison with design interaction equations. Three full size two-bay unbraced frames were tested to study the interaction of beam-columns within a frame. The studies indicate that a proposed interaction equation provides an accurate prediction of the strength of a beam-column in planar unbraced frames.
Dissert. Abstr.

N78-27292*# General Electric Co., Utica, N. Y. Dept. of Aerospace Electronics Systems.
PARTS APPLICATION HANDBOOK STUDY Final Report, Oct. 1977 - Feb. 1978
Feb. 1978 208 p
(Contract NAS8-32662)
(NASA-CR-150734) Avail: NTIS HC A10/MF A01 CSCL 05A

The requirements for a NASA application handbook for standard electronic parts are determined and defined. This study concentrated on identifying in detail the type of information that designers and parts engineers need and expect in a parts application handbook for the effective application of standard parts on NASA projects.
G.Y.

N78-27293*# National Aeronautics and Space Administration, Washington, D. C.
NASA METRICATION ACTIVITIES
Peppino N. Vlannes Dearbonn, Mich. Soc. of Manufacturing Engr. 1978 9 p Presented at WESTEC '78 Conf., Los Angeles, Mar. 1978; sponsored by Soc. of Manufacturing Engr.
(NASA-TM-79522; IQ78-199) Avail: NTIS HC A02/MF A01 CSCL 05B

NASA's organization and policy for metrification, history from 1964, NASA participation in Federal agency activities, interaction with nongovernmental metrication organizations, and the proposed metrication assessment study are reviewed. J.A.M.

N78-27294# Illinois State Dept. of Transportation, Springfield. Bureau of Materials and Physical Research.
ZINC ANODES TO CONTROL BRIDGE DECK DETERIORATION Final Report, Nov. 1973 - Dec. 1977
John L. Saner Dec. 1977 25 p
(PB-277646/6; FHWA/IL/PR-77/69) Avail: NTIS HC A02/MF A01 CSCL 13C

The use of sacrificial zinc ribbon anodes is discussed for cathodically protecting the reinforcing steel in a bridge deck, thus controlling spalling. After three years the zinc anodes were found to be capable of protecting only a 7.62 cm wide strip each side of the anodes.
GRA

N78-27295# Textron Bell Aerospace Co., Buffalo, N. Y.
TESTS FOR PARTICLE CONTAMINATION OF THE ENGINE INLET AIRFLOW FROM THE LACV-30 AIR MANAGEMENT SYSTEM Final Report
R. F. Speth Jan. 1977 16 p
(Contract DAAK02-75-C-0149)
(AD-A053642; Rept-7467-928003) Avail: NTIS HC A02/MF A01 CSCL 01/3

Tests were conducted to demonstrate that the LACV-30 Air Management System removes at least 95 percent of the entering sand and dust. Analysis of 1 micron filters used in isokinetic sampling probes to measure entering and existing contamination levels indicated that the system removed 97 percent of the contamination entering during 22 minutes of vehicle operation in a high-sand environment.
Author (GRA)

N78-27296# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Concrete Lab.
TESTS OF HIGH-RANGE WATER-REDUCING ADMIXTURES Final Report
Bryant Mather Apr. 1978 26 p refs
(AD-A053998; WES-MP-C-78-3) Avail: NTIS HC A03/MF A01 CSCL 11/2

In the last few years products described as water-reducing admixtures that permit a concrete mixture to have of the order of 20 percent of the mixing water removed without loss of slump have appeared on the market. Advantage can be taken of this effect in the same ways that advantage has been taken of the effect of the several well-known water-reducing admixtures that have been available for many years, i.e., (1) concrete can be made having greater workability and easier placement with no reduction of cement content and no significant change in strength; or (2) the workability can be kept the same, the water content reduced, the cement content left the same, and higher strengths obtained; or (3) the workability and strength can be kept the same while the cement content is reduced, with resulting cost savings. The products that have achieved the greatest recent prominence seem to be marketed primarily for increased strength or increased fluidity rather than reduced cost of materials.
GRA

N78-27297# Los Alamos Scientific Lab., N. Mex.
NRIP-FUNDED MAGNETIC REFRIGERATOR DEVELOPMENT PROJECT Final Report, 1 Jul. 1975 - 1 Oct. 1977
W. A. Steyert Feb. 1978 6 p refs
(Contract W-7405-eng-36)
(LA-7111-MS) Avail: NTIS HC A02/MF A01

A brief overview of magnetic refrigeration is given. Rudimentary refrigerators and the performance expected from more advanced designs are discussed along with the heat transfer experiments performed to provide the data necessary for implementation of those designs.
ERA

N78-27298# Hanford Engineering Development Lab., Richland, Wash.
EXPERIMENTAL AND THEORETICAL STUDIES ON WATER AND GAS RELEASE FROM HEATED CONCRETE
J. D. McCormack and A. K. Postma 1977 11 p refs Presented at Post Accident Heat Removal Information Exchange Meeting, Chicago, 2 Nov. 1977
(Contract EY-76-C-14-2170)
(HEDL-SA-1380; Conf-771108-8) Avail: NTIS HC A02/MF A01

Procedures currently used in licensing of nuclear facilities require analysis of postulated accidents which are more severe than design basis events. For breeder program reactors, some accidents in this severe category involve spillage of sodium coolant onto concrete protected by a steel liner. Heat transfer through the liner heats the concrete, causing a part of the mixing water and other gases to be driven off. These gases would add to pressure in the containment atmosphere, and the water vapor can form hydrogen if it contacts sodium. Evaluations of containment integrity for such postulated accidents will be aided by knowledge of how much water and other gases are released from heated concrete.
ERA

N78-27299# National Technical Information Service, Springfield, Va.

CONSTRUCTION EQUIPMENT, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, May 1976 - Mar. 1978
Guy E. Habercom, Jr. Apr. 1978 176 p Supersedes NTIS/PS-77/0351, NTIS/PS-76/0373, NTIS/PS-75/391, and COM-73-11378
(NTIS/PS-78/0377/8; NTIS/PS-75/391; NTIS/PS-76/0373; NTIS/PS-77/0351; COM-73-11378) Avail: NTIS HC $28.00/MF $28.00 CSCL 12C

Construction equipment used in roadbuilding, mining, earth handling, and general construction is described and analyzed in these Government-sponsored research reports. Translations of foreign reports have been excluded. (This updated bibliography contains 171 abstracts, 69 of which are new entries to the previous edition.) GRA

N78-27300# Illinois Inst. of Tech., Chicago. Dept. of Civil Engineering.
FOUNDATION RESPONSE TO SOIL TRANSMITTED LOADS
Satya N. Varadhi, Surendra K. Saxena, and Eben Vey Dec. 1977 126 p refs
(Grant NSF GK-41903)
(PB-279055/8; GEOTECHNICAL-SER-77-201) Avail: NTIS HC A07/MF A01 CSCL 13M

Foundation response produced by stress waves propagating from underlying soils. A circular footing was located at the surface and at different depths of burial and a transient load was applied to the footings through the underlying soils. Stresstime and strain-time histories were recorded through embedded gages. These records were correlated with acceleration-time records of the input load and foundation response tp provide a comprehensive picture of stresses and strains in a soil mass subjected to earthqauke type loading. Also included are some static and dynamic experiments, conducted using a thin layer of compressible material buried at depths of one radius below the footing. GRA

N78-27301# Kariotis, Kesler, and Allys, South Pasadena, Calif.
MITIGATION SEISMIC HAZARDS IN EXISTING UNREINFORCED MASONRY WALL BUILDINGS: PERFORMANCE OF UNDESIGNED AND MODIFIED ELEMENTS. EVALUATION OF MODIFICATION METHODS
31 Mar. 1978 36 p refs Sponsored in part by NSF
(PB-278927/9) Avail: NTIS HC A03/MF A01 CSCL 13M

Modifications to existing structures using unreinforced masonry walls are considered. Evaluated were the performance of undesigned elements that participate in structural response, and current modification methods applied to these undesigned elements. Considered were ground motions varying from moderate to severe. The survey indicates commonality of building construction methods, range of building dimension, and use of masonry materials. GRA

N78-27302# Portland Cement Association, Skokie, Ill.
DESIGN AND CONSTRUCTION OF LARGE-PANEL CONCRETE STRUCTURES. REPORT 4: A DESIGN APPROACH TO GENERAL STRUCTURAL INTEGRITY Final Task Report
Donald M. Schultz, Eric F. P. Burnett, and Mark Fintel Oct. 1977 139 p refs
(Contract HUD-h-2131R)
(PB-278757/0; HUD/RES-1283; ISBN-0-89312-032-4) Avail: NTIS HC A07/MF A01 CSCL 13M

Behavior of large panel concrete structures damaged due to abnormal loadings was discussed quantitatively. The alternate path approach was used to develop indirect design criteria which assure general structural integrity in large panel concrete structures. Bridging of locally damaged areas occurs while stability of the partially damaged structure is maintained. The design procedures are in the terms of tensile tie forces for transfers, longitudinal, vertical and peripheral ties, deformability requirements, wall layout, etc. GRA

N78-27303# Transport and Road Research Lab., Crowthorne (England). Earthworks and Underground Pipes Div.
A TEST TO DETERMINE THE BENDING MOMENT RESISTANCE OF RIGID PIPES
Guy Brennan 1978 25 p refs
(PB-279128/3; TRRL-SUPPLEMENTARY-348; ISSN-0305-1315) Avail: NTIS HC A02/MF A01 CSCL 14B

A practical test for the measurement of BMR is described that is based on using a standard testing machine adapted to apply a four point loading system to 100 mm, 150 mm, 225 mm diameter clay and 225 mm, 200 mm, 375 mm concrete pipes. From the ultimate loads obtained from a series of BMR and British Standard crushing tests, the ultimate stresses were calculated. It was found from a comparison of these ultimate stresses that the pipes were not isotropic. It was also found that there was little or no significant correlation between the BMR and crushing strength of clay concrete pipes. GRA

N78-27304# Martin and Cagley, Rockville, Md.
SEISMIC HARDENING OF UNREINFORCED MASONRY WALLS THROUGH A SURFACE TREATMENT, PHASE 1
James R. Cagley 31 Mar. 1978 29 p refs
(Contract NSF C-AEN-77-19888)
(PB-278930/3) Avail: NTIS HC A03/MF A01 CSCL 13M

The feasibility of using a coating or surface treatment to achieve seismic hardening of unreinforced masonry walls is studied. This was accomplished by assembling available information on methods of reinforcing existing masonry which are now in use, by reviewing available test data of unreinforced masonry, by researching available coatings, and by determining anticipated required stress levels. The use of surface bonding cement to accomplish seismic hardening of existing unreinforced masonry walls is considered. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N78-27305 New Mexico State Univ., Las Cruces.
CONCATENATED CONVOLUTIONAL CODES: APPLICATIONS TO DEEP-SPACE TELECOMMUNICATION Ph.D. Thesis
Michael Hankamer 1977 211 p
Avail: Univ. Microfilms Order No. 78-07995

The performance of concatenated convolutional codes used for the Voyager missions to Jupiter and Saturn are examined. The fundamental results are as follows: (1) the codes, called the composite, admit an optimal decoder algorithm; (2) the optimal two stage decoder is degenerate, that is, only the outer member of the decoder pair is necessary, and performance suffers by comparison with the optimal decoder; (3) the examination of the codes defines a burst error of length l and the number of such burst errors is computed for each l; and (4) the error statistics were used to estimate the performance of four suboptimal outer decoder configurations designed to use the burst nature of the inner decoder output. It is concluded that concatenation is best limited to fixed channels required to pass data sets of differing quality requirements. In that way the composite code can be effectively utilized. Dissert. Abstr.

N78-27306 Carnegie-Mellon Univ., Pittsburgh, Pa.
ANALYSIS OF INTEGRATED VOICE AND DATA COMMUNICATION NETWORK Ph.D. Thesis
Lih-Hsing Chang 1978 189 p
Avail: Univ. Microfilms Order No. 780185

The performance of an integrated voice and data communication network is studied. Different characteristics from other communication networks and a different set of key parameters for its performance are addressed. The relationship of and the trade-off between the key parameters are also discussed. A new integrated switch is designed to support both types of communications; line switch for voice and packet switch for data. Several memory management and buffer assignment schemes are discussed. An unconventional secondary storage for switching processor is modeled and the advantages and disadvantages are thoroughly discussed. The design problem of how to share the communication link skew on each link are discussed. A frame

skew assignment problem is investigated as a mixed integer linear program. A heuristic algorithm is developed to find a local optimal assignment in relatively short computation time.
Dissert. Abstr.

N78-27307 California Univ., Davis.
EVALUATION OF THE CONSTRAINED BAYESIAN METHODOLOGY FOR SIGNAL DETECTION Ph.D. Thesis
Richard Stanley Poulsen 1977 210 p
Avail: Univ. Microfilms Order No. 7809247

The constrained Bayesian methodology (CBM) is a new approach to the design of structurally constrained statistical inference and decision rules. The methodology is based on constrained minimum mean-squared error estimation of posterior probabilities. The solution for the estimates is specified by a set of linear equations in terms of only the prior probabilities, and moments and conditional moments of prescribed functionals of the observations. The analyses show that the CBM is a viable design tool for a wide variety of detection problems, being particularly useful for non-Gaussian noise for which there is no general theory for optimum receiver design. The analyses also provide insight into conventional structures such as matched-filter tapped-delay line receivers for high-speed data transmission, and suggest novel structures such as a modified quadrature correlator receiver for noncoherent reception.
Dissert. Abstr.

N78-27308*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
POTENTIAL END-TO-END IMAGING INFORMATION RATE ADVANTAGES OF VARIOUS ALTERNATIVE COMMUNICATION SYSTEMS
Robert F. Rice 15 Jun. 1978 26 p refs
(Contract NAS7-100)
(NASA-CR-157263; JPL-Pub-78-52) Avail: NTIS HC A03/MF A01 CSCL 17B

Various communication systems were considered which are required to transmit both imaging and a typically error sensitive, class of data called general science/engineering (gse) over a Gaussian channel. The approach jointly treats the imaging and gse transmission problems, allowing comparisons of systems which include various channel coding and data compression alternatives. Actual system comparisons include an Advanced Imaging Communication System (AICS) which exhibits the rather significant potential advantages of sophisticated data compression coupled with powerful yet practical channel coding. G.G.

N78-27309*# George Washington Univ., Washington, D. C. Program of Policy Studies in Science and Technology.
VIDEOCONFERENCING VIA SATELLITE. OPENING CONGRESS TO THE PEOPLE: TECHNICAL REPORT
Fred B. Wood, Vary T. Coates, Robert L. Chartrand, and Richard F. Ericson Feb. 1978 108 p refs
(Grant NsG-3130)
Avail: NTIS HC A06/MF A01 CSCL 17B

The feasibility of using satellite videoconferencing as a mechanism for informed dialogue between Congressmen and constituents to strengthen the legislative process was evaluated. Satellite videoconferencing was defined as a two-way interactive television with the TV signals transmitted by satellite. With videoconferencing, one or more Congressmen in Washington, D. C. can see, hear and talk with groups of citizens at distant locations around the country. Simultaneously, the citizens can see, hear and talk with the Congressmen. B.B.

N78-27310# Harry Diamond Labs., Adelphi, Md.
ELECTROMAGNETIC WAVES IN ANISOTROPIC DIELECTRIC SLABS
Nick Karayianis Apr. 1978 27 p refs
(AD-A053898; HDL-TR-1845) Avail: NTIS HC A03/MF A01 CSCL 20/14

The theory of electromagnetic wave modes in an infinite anisotropic dielectric slab is reviewed. The theory is specialized to lithium niobate cut with its z-axis in the plane of the slab. It is shown that pure transverse electric (TE) and transverse magnetic (TM) modes propagate along the principal axes of the dielectric but that coupled TE and TM like modes result for propagation at small angles with respect to these axes. The lowest order modes--the fundamental TE(0) and TM(0) modes--are determined, and the associated fields are plotted. One higher order mode--the TM(2)-like mode propagating at an angle of 19 deg with respect to one of the principal axes--also is plotted. These results relate to the problem of the interaction of sheet laser beams with surface acoustic waves. Author (GRA)

N78-27311# Purdue Research Foundation, Lafayette, Ind.
MICROPROCESSOR-CONTROLLED COMMUNICATIONS IN AIR TERMINAL NAVIGATION SYSTEMS Final Report, 1 Nov. 1975 - 31 Dec. 1977
Stephen E. Belter, Craig R. Williams, and Steven C. Bass Jan. 1978 181 p
(Contract DOT-FA74WA-3518)
(AD-A052819; FAA-RD-78-25) Avail: NTIS HC A09/MF A01 CSCL 17/2

The implementation of some old and new techniques to the problem of command and control signaling within a Category 3 instrument landing system are reported. The old techniques include the use of tone signaling over balanced lines, along with isolation transformers and gas discharge elements for lightning protection. The new methods include the application of microprocessor control devices to supervise, format, and interpret all communications. Additional features afforded by the microprocessor approach include automatic and manual maintenance logging at the control tower, more reliable transmission error detection, enhanced system status displays, and a self-contained operator training feature.
G.Y.

N78-27312*# National Aeronautics and Space Administration, Washington, D. C.
SURFACE OF OFFSET DUAL REFLECTOR ANTENNA
Y. Mizuguchi and H. Yokoi Apr. 1977 8 p refs Transl. into ENGLISH from Trans. Inst. Electron. Commun. Eng. Jap., Part B (Japan), v. 58-B, no. 2, 1975/2 p 94-95 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original document prepared by Kokusai Denshin Do., Ltd., Tokyo
(Contract NASw-2791)
(NASA-TT-F-17407) Avail: NTIS HC A02/MF A01 CSCL 20N

By using geometrical optics, attempts are made to determine a surface which can make the main beam direction of the antenna parallel to the axis of the emission apparatus. It is demonstrated that it is generally impossible to modify the reflector surface in order to control the intensity distribution of the electric field on the open surface of such an antenna. L.S.

N78-27313# National Aviation Facilities Experimental Center, Atlantic City, N. J.
SATELLITE COMMUNICATIONS MODE SIMULATION TESTS FOR OCEANIC AIR TRAFFIC CONTROL Final Report, Jun. - Nov. 1976
Francis W. Jefferson Mar. 1978 48 p ref
(FAA Proj. 171-252-200)
(AD-A052546; FAA-NA-77-37; FAA-RD-77-187) Avail: NTIS HC A03/MF A01 CSCL 17/2

Simulated satellite system configurations and channel access control tests were conducted with air traffic control test subjects to determine controller reaction to the satellite mode of communications and their interaction with associated input/output interfaces. The tests were designed to simulate an oceanic ATC environment supported by satellite communications and surveillance. Data were acquired for controller test subject reactions to different voice and data communications delay/restriction situations, voice channel queuing, data communications message length and format constraints, acceptance of required communications disciplines, and the mix of voice and data communications when there was a choice between the two methods of communication. Results were: (1) Controller test subjects favored using data communication to accomplish routine controller-to-pilot communications transactions and voice communication to resolve difficult traffic control situations; (2) actual data from the test logs corroborated test subjects' stated preference; and (3) controller test subjects tended to adapt their communications procedure options to be compatible with the communications system disciplines. G.G.

N78-27314# Institute for Telecommunication Sciences, Boulder, Colo.

APPLICATIONS GUIDE FOR PROPAGATION AND INTERFERENCE ANALYSIS COMPUTER PROGRAMS (0.1 TO 20 GHz)
M. E. Johnson and G. D. Gierhart Mar. 1978 184 p refs
(Contracts DOT-FA68WAI-145; DOT-FA74WAI-424)
(AD-A053242; FAA-RD-77-60) Avail: NTIS
HC A09/MF A01 CSCL 20/14

Ten computer programs useful in estimating the service coverage of radio systems operating in the frequency band from 0.1 to 20 GHz are reported. These programs were used to obtain a wide variety of computer-generated microfilm plots such as transmission loss versus path length and the desired-to-undesired signal ratio at a receiving location versus the distance separating the desired and undesired transmitting facilities. Emphasis was placed on the types of outputs available and the input parameter requirements. The propagation model used with these programs is applicable to air/ground, air/air, ground/satellite, and air/satellite paths. It can also be used for ground-to-ground paths that are line-of-sight or smooth earth. G.G.

N78-27315# Rome Air Development Center, Griffiss AFB, N.Y.
DESIGN OF MICROSTRIP PATCH ANTENNA ELEMENTS
Anders G. Derneryd Feb. 1978 31 p refs
(AD-A053728; RADC-TR-78-46) Avail: NTIS
HC A03/MF A01 CSCL 09/1

A collection of design formulas for circular and rectangular microstrip antennas excited in the lowest resonance mode are presented. The elements are modeled as cylindrical resonators with equivalent magnetic currents around the perimeters. Fringing fields represent extensions of the elements and have been considered when resonance dimensions are determined. The Q-factors are usually high, making the instantaneous bandwidths narrow. A two-section feed network has been used to simultaneously match the elements at two frequencies separated + or - 12 percent. Both a circular and a square microstrip radiator have been designed and fabricated. The radiation from the feed lines was suppressed by designing them in stripline. An extensive bibliography of microstrip antenna work is included.
Author (GRA)

N78-27316# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
MULTIPLE-PROCESSOR IMPLEMENTATIONS OF MESSAGE-PASSING SYSTEMS M.S. Thesis
Robert H. Halstead, Jr. Apr. 1978 175 p refs
(Contract N00014-75-C-0661)
(AD-A054009; MIT/LCS/TR-198) Avail: NTIS
HC A08/MF A01 CSCL 17/2

The goal of this thesis is to develop a methodology for building networks of small computers capable of the same tasks now performed by single larger computers. Such networks promise to be both easier to scale and more economical in many instances. The mu calculus, a simple syntactic formalism for representing message-passing computations, is presented and augmented to serve as the semantic basis for programs running on the network. The augmented version includes cells, tokens, and semaphores, as well as primitives for side-effect-free computation. Tokens, a novel construct, allow certain simple communication and synchronization tasks without involving fully general side effects. The network implementation presented supports object references, keeping track of them by using a new concept, the reference tree. A reference tree is a group of neighboring processors in the network that share knowledge of a common object. Also discussed are mechanisms for handling side effects on objects and strategy issues involved in allocating computations to processors. Author (GRA)

N78-27317# Harry Diamond Labs., Adelphi, Md.
COMPONENT DAMAGE FROM ELECTROMAGNETIC PULSE (EMP) INDUCED TRANSIENTS
Joseph R. Miletta Oct. 1977 186 p refs
(DA Proj. 1W0-62118-AD-51)
(AD-A053899; HDL-TM-77-22) Avail: NTIS
HC A09/MF A01 CSCL 14/2

The Lance Vulnerability and Hardening Test Program was supported by a number of in-laboratory experiments on various component types. Of prime concern was the establishment of component EMP thresholds to be used in establishing the vulnerability level of the system. Reported are pulsed transient tests on over 50 component types. Testing concentrated on sensitive semiconductor components, and about 1800 individual devices were damage tested. The tests used rectangular pulses varying in width from 5 ns to 30 micros. Numerous nonsemiconductor components also were characterized. Author (GRA)

N78-27318# Defense Communications Engineering Center, Reston, Va.
AN ARCHITECTURAL MODEL FOR THE ACCESS AREA/BACKBONE ALLOCATION PROBLEM
W. P. Dotson Dec. 1977 51 p refs
(AD-A053946; AD-E100036) Avail: NTIS HC A04/MF A01
CSCL 17/2

This report develops an architectural model for performing a macroscopic design/analysis of terrestrial voice communication networks. The analysis is based on the relationships between average properties of networks: geographical area to be serviced, number of switches and the average area served by a switch, number of backbone links and the average number links homed on a typical switch, the average capacity andl length of backbone links, the number of user installations, the average length and capacity and length of backbone links, the number of user installations, the average length and capcity of access links, and the average offered load to each access link. Other important parameters are a total budget constraint and allocation criteria for expending the budget in access area design, backbone switches, and backbone links. These last parameters have a significant impact on the end to end performance of the network under routine conditions as well as the survivability of the network. Author (GRA)

N78-27319# Duke Univ., Durham, N. C.
COHERENT EXCITATION OF DIPOLE MOMENTS BY RELATIVISTIC CHARGED PARTICLES Final Report, 15 Oct. 1976 - 14 Nov. 1977
Hermann R. Robl and Demos Dialetis Apr. 1978 11 p
(Grant DAAG29-77-G-0016)
(AD-A053807; ARO-14729.6-P) Avail: NTIS
HC A02/MF A01 CSCL 20/3

This research project was concerned with a theoretical investigation of the generation of electromagnetic radiation in polarizable or conducting media by relativistic charged particles. Results are contained in the following papers: Generation of Coherent X-Rays by a Relativistic Charged Particle Traveling Through a Crystal; Generation of Coherent Radiation in a Resonant Medium by a Relativistic Charged Particle, Cerenkov Radiation at the Resonance Frequency of an Amplifying Medium; Generation of Cerenkov Radiation at the Cyclotron Frequency of a Conducting Medium; Set of Electric Dipoles Under the Influence of an External Field; and Equivalence of the Ewald-Oseen Extinction Theorem as a Non-Local Boundary Value Problem with Maxwells Equations and Boundary Conditions. Author (GRA)

N78-27320# Los Alamos Scientific Lab., N. Mex.
CHARACTERISTICS OF LATE-TIME STRIATIONS OBSERVED DURING OPERATION STRESS
John Heren Wolcoti, David Jay Simons (EG and G, Inc., Los Alamos, N. Mex.), Timothy Eric Eastman (EG and G, Inc., Los Alamos, N. Mex.), and Thomas Joseph Fitzgerald (EG and G, Inc., Los Alamos, N. Mex.) 1978 14 p Presented at NRL Symp. on Ionospheric Effects, Wash, D. C., 24-26 Jan. 1978
(Contract W-7405-eng-26)
(LA-UR-77-2835; Conf-780106-2) Avail: NTIS
HC A02/MF A01

Results are presented on an experiment in progress of data analysis. Actual satellite communication links were studied through structured barium plasma clouds intended to simulate many aspects of the highly disturbed, post nuclear explosion upper atmosphere. Late time spatial decay of plasma striations, or filaments, imbedded within the barium ion cloud was also investigated. Author (ERA)

N78-27321# Brookhaven National Lab., Upton, N. Y.
WILL LIGHTWAVE COMMUNICATION BE USEFUL
Alan Thorndike 1977 5 p Presented at Isabelle Workshop, Upton, N. Y., 18 Jul. 1977
(Contract EY-76-C-02-0016)

(BNL-23540: Conf-770753-3) Avail: NTIS HC A02/MF A01

Within the last ten years glass fibers have been developed that are capable of transmitting optical signals over distances that are long enough to have potential use for many kinds of communications. They may replace wires, coaxial cable, and microwave links in many applications, and some forecasters expect them to do so within the next ten years. A technology assessment of lightwave communication systems is presented. ERA

N78-27322# California Univ., Livermore. Lawrence Livermore Lab.

COMPUTER MODELING OF A LOG-PERIODIC ANTENNA

F. J. Deadrick 5 Dec. 1977 13 p refs

(Contract W-7405-eng-48)

(UCRL-52372) Avail: NTIS HC A02/MF A01

A computer model of a six element, log periodic antenna is described and operated in both the time and frequency domains to calculate antenna input impedance, forward and backward incident-field transfer functions, and transient response characteristics. Computed results are compared with experimental test data to demonstrate the model's reliability. Additionally, the model is used to assess the antenna's coupling to an incident EMP wave to provide a practical illustration of the model's utility and to indicate its potential for further development. ERA

N78-28035# Joint Publications Research Service, Arlington, Va.

HOW TO IMPROVE THE RELIABILITY OF ANTENNA STRUCTURES

G. A. Savitsky *In its* Transl. on USSR Sci. and Technol. (JPRS-71393) 30 Jun. 1978 p 16-21 refs Transl. into ENGLISH from Vestn. Svyazi (Moscow), no. 2, Feb. 1978 p 29-30 (For primary document see N78-28033 18-99)

Copyright. Avail: NTIS HC A05/MF A01

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N78-27323 Marquette Univ., Milwaukee, Wis.

MICROWAVE FERRITES AND MICROWAVE ROTARY MACHINES Ph.D. Thesis

Moni George Mathew 1977 104 p

Avail: Univ. Microfilms Order No. 7801927

The properties of ferrites in a waveguide as a suitable material for the rotor and the stator of a microwave reluctance or microwave induction motor were studied. The properties of a ferrite filled waveguide were studied for zero d.c. magnetic bias. Theoretical expressions for the tensor permeability were obtained and the Maxwell's equations inside the ferrite sample for zero d.c. magnetic bias were solved. The phase constant and the attenuation constant of the ferrite sample were computed and were compared with the experimental results. The theoretical expressions for the tensor permeability of a ferrite sample for a d.c. magnetic bias along the two directions transverse to the direction of propagation were calculated. The microwave reluctance motor was designed and constructed. The theoretical model and the experimental results were compared.

Dissert. Abstr.

N78-27324 Princeton Univ., N. J.

HIGH-FIELD GENERATION OF INTERFACE STATES AND ELECTRON TRAPS IN MOS CAPACITORS Ph.D. Thesis

Ching-Shi Jenq 1978 93 p

Avail: Univ. Microfilms Order No. 7807477

A low temperature C-V displacement (LTD) technique was developed to measure the number of interface states in the central region of the silicon bandgap (the mid 0.7 eV range at 90 K) from a set of nonequilibrium C-V curves taken at low temperature. The basis principle of the LTD method is used to determine the energy distribution of interface states in a portion of the silicon bandgap by varying the temperature of the sample. The interface state density began to increase after the sample was warmed up. The amount of interface state generation following warmup was found to be strongly dependent on the stress field and stress time. A high field generation of electron traps was observed after the samples were stressed with fields greater that about 6.8 MV/cm. The traps and the trapped electrons were stable up to at least 160 C. The thickness dependence of flatband shift and the bias dependence of photocurrent in both indicated that the trap generation was bulk effect. The electronic capture cross section of the traps was found to be approximately 9 x 10 to the minus 14 sq cm and was idependent of the stress fields and the stress times that were covered in the experiments. Dissert. Abstr.

N78-27325 Wisconsin Univ., Madison.

STEADY STATE AND TRANSIENT ANALYSIS OF A SHORT PRIMARY LINEAR INDUCTION MOTOR USING A d,q AXIS POLE-BY-POLE MODEL Ph.D. Thesis

Thomas Arthur Nondahl 1977 363 p

Avail: Univ. Microfilms Order No. 78-04438

The coupled circuit model for a round rotor induction machine was modified by formulating an equivalent circuit for each of the secondary (rotor) poles to allow simulation of linear induction machine (LIM) behavior. The d,q axis representation of a four pole machine led to a tenth order differential equation (increased by two orders for each additional pole pitch of secondary material modeled) capable of rapid and inexpensive predictions of LIM behavior. Solution of both steady state and transient conditions with either sinusoidal or nonsinusoidal excitation was feasible with the model. The derivation of formulas to calculate the model's equivalent circuit parameters showed that formulas for round rotor induction machines may be applied, after a change of variable to linear induction machines. The only exception was the calculation of end turn leakage reactance, which uses a transmission line formula. Model predictions indicated the formula for primary leakage reactance gave a value which was too small. Dissert. Abstr.

N78-27326* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

FIELD EFFECT TRANSISTOR AND METHOD OF CONSTRUCTION THEREOF Patent

William R. Fletner, inventor (to NASA) Issued 9 May 1978 6 p Filed 23 Jun. 1976 Supersedes N76-26394 (14 - 17, p 2181)

(NASA-Case-MFS-23312-1; US-Patent-4,087,902; US-Patent-Appl-SN-699012; US-Patent-Class-29-571; US-Patent-Class-29-578; US-Patent-Class-357-91) Avail: US Patent Office CSCL 09A

A field effect transistor is constructed by placing a semiconductor layer on an insulating substrate so that the gate region is separated from source and drain regions. The gate electrode and gate region of the layer are of generally reduced length, the gate region being of greatest length on its surface closest to the gate electrode. This is accomplished by initially creating a relatively large gate region of one polarity, and then reversing the polarity of a central portion of this gate region by ion bombardment, thus achieving a narrower final gate region of the stated configuration.

Official Gazette of the U.S. Patent Office

N78-27327 California Univ., Irvine.

REDUNDANCY REDUCTION IN RECURSIVE LINEAR ESTIMATION Ph.D. Thesis

Hamid Mashayekh Faridani 1976 126 p

Avail: Univ. Microfilms Order No. 7808230

The properties of a discrete time Kalman filter which is driven by pre-processed data is examined with the ultimate goal of generating analytical methods of comparing different pre-processing schemes. The problem was formulated using a binary value decision variable and the measurement model. With a scalar Gauss-Markov sequence as an input signal, analytic expressions for evaluating the steady-state probabilities of processing or not processing a data piece for two of the most commonly used redundancy reduction techniques; namely, the fixed aperture and the floating aperture were developed. As an

example, the behavior of a Kalman filter which receives measurement accurding to a Poisson process was investigated. Using other examples, it was shown that the upper bound is an excellent approximation to the error corvariance expected value. Dissert. Abstr.

N78-27328 California Univ., Davis.
DESIGN AND IMPLEMENTATION TECHNIQUES FOR TWO-DIMENSIONAL DIGITAL FILTERS Ph.D. Thesis
Richard Edward Twogood 1977 123 p
Avail: Univ. Microfilms Order No. 7809262

The problem of implementing 2-D nonrecursive filters is investigated. An optimal sectioning procedure is formulated, and examples are given which show that sectioning can be significantly superior to other common implementations for a large class of filtering problems. A very efficient design procedure for separable 2-D recursive filters is presented. This procedure is useful in designing quarter-plane recursive filters, and is applicable to a limited subset of design problems. Finally, two techniques are presented for designing stable recursive filters of the more general half-plane variety. These techniques incorporate a recently developed 2-D spectral factorization procedure and a nonlinear optimization to obtain filters to approximate an arbitrary magnitude response, with a zero phase response if desired. Example designs are provided for each technique discussed. Dissert. Abstr.

N78-27329 Stanford Univ., Calif.
DETECTION OF INTERMITTENT FAILURES IN COMBINATIONAL CIRCUITS Ph.D. Thesis
Jacob Savir 1978 167 p
Avail: Univ. Microfilms Order No. 7808839

An optimal fault detection experiment is reported for detecting intermittent faults in combinational circuits. Two optimality criteria were used in designing the experiment: maximizing the probability of fault detection, and minimizing the mean testing time for a given test quality. Detection of both single and multiple intermittent faults was considered. The optimal intermittent fault detection experiment was achieved by applying the input vectors with an optimal probability distribution. It is shown that a repeated application of test inputs primarily designed to detect permanent faults might be very inefficient in detecting intermittent faults and, therefore, the use of the optimal experiment is highly important. Dissert. Abstr.

N78-27330*# National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD FOR ANALYZING RADIATION SENSITIVITY OF INTEGRATED CIRCUITS Patent Application
Michael Gauthier (JPL) and A. G. Stanley, inventors (to NASA) (JPL) Filed 30 Jun. 1978 21 p
(Contract NAS7-100)
(NASA-Case-NPO-14350-1; US-Patent-Appl-SN-921627) Avail: NTIS HC A02/MF A01 CSCL 09C

A technique for analyzing integrated circuits for radiation sensitivity is provided. The method includes applying an intense penetrating radiation beam, such as a 30 keV beam from a scanning electron microscope, which is narrow enough to irradiate only one component (such as a single transistor) of the circuit at a time. The circuit is operated during irradiation of each component in sequence, with a predetermined radiation dose such as 1,000,000 rad, until the circuit fails. Then a new integrated circuit is substituted for the failed one, the beam is narrowed further to cover only a portion of the failed component, such as the beam which covers the base emitter junction of the failed transistor, and a high radiation dosage is applied to component portions in sequence. In this way, it is possible to determine precisely which portions of which components of a circuit give rise to radiation sensitivity of the circuit. NASA

N78-27331# Hughes Aircraft Co., Torrance, Calif. Electron Dynamics Div.
DEFENSE SATELLITE COMMUNICATIONS SYSTEM TRAVELING WAVE TUBE AMPLIFIER LIFE TEST REPORT: VOLUME 2. LOW LEVEL TWTA Final Report, 1 Apr. 1971 - 1 Nov. 1977
M. L. Kahn 1 Feb. 1978 476 p refs
(Contract F04701-74-C-054221)
(AD-A053740) Avail: NTIS HC A21/MF A01 CSCL 09/1

Data accumulated over a six (6) year life test period on DSCS 2 flight equivalent TWTA's is presented. Evaluation of the data is to determine trends and long term performance characteristics of traveling tube amplifiers. Author (GRA)

N78-27332# Naval Ocean Systems Center, San Diego, Calif.
DEVELOPMENT OF A TRIPLE-PRODUCT CONVOLVER USING ZINC OXIDE ON SILICON Research and Development Report, Oct. 1976 - Sep. 1977
E. C. Jelks 30 Sep. 1977 42 p refs
(AD-A053853; NOSC/TR-218) Avail: NTIS HC A03/MF A01 CSCL 09/1

Triple-product convolution has been demonstrated with two modulated 80 MHz carrier signals and a third signal consisting of a set of dc voltages. This operation was performed in realtime with two different surface acoustic wave saw devices built on silicon substrates. The transduction of SAWs onto silicon is by means of a thin overlying film of zinc oxide, which is deposited by RF sputtering in a partial oxygen atmosphere. Transducer patterns are defined by 'lift-off' photolithography. Good predictions of steady-state device behavior were made using mathematical models, although observed long term memory effects, probably associated with trapping of charge in the 7NO and the Si/SiO2 interface, are not fully understood. Author (GRA)

N78-27333# Varian Associates, San Carlos, Calif. EIMAC Div.
MANUFACTURING METHODS AND TECHNOLOGY (MM AND T) MEASURE FOR FABRICATION OF LOW VOLTAGE START SEALED BEAM ARC LAMPS Quarterly Progress Report, 1 Oct. - 31 Dec. 1977
Roy Roberts and Tim Bell 27 Jan. 1978 29 p
(Contract DAAB07-76-C-0034)
(AD-A053376; EIMAC-QPR-76-3) Avail: NTIS HC A03/MF A01 CSCL 13/1

A program is in progress to establish a production capability for the purpose of meeting estimated military needs for the X6335, a 1kW sealed beam xenon arc lamp with low voltage starting mechanism. In accordance with the requirements of the contract, the third engineering sample is still undergoing fabrication to meet specification. Improvements were made to reduce manufacturing costs and improve reliability. These included: Molybdenum insert was added to improve heat transfer from anode to heatsink; Anode base changed from steel to copper; Stinger bearings changed to sapphire to reduce friction; New mandrel machined and precision polished; Test bench set-up to evaluate individual reflectors for focal point location and relative output readings; Lamp with demountable electrodes designed to study electrode optimization; and Stinger mechanism cycle tested and evaluated. GRA

N78-27334# Orincon Corp., La Jolla, Calif.
SECOND-ORDER OUTPUT STATISTICS OF THE ADAPTIVE LINE ENHANCER Final Report, 1 Oct. 1976 - 30 Sep. 1977
J. T. Rickard and J. R. Zeidler 1 Dec. 1977 23 p refs
(Contract N66001-77-C-0124)
(AD-A054011; NOSC/TR-202) Avail: NTIS HC A02/MF A01 CSCL 09/4

The adaptive line enhancer (ALE) is an adaptive digital filter designed to suppress uncorrelated components of its input, while passing any narrowband components with little attenuation. The purpose of this paper is to analyze the second-order output statistics of the ALE in steady-state operation, for input samples consisting of weak narrowband signals in white Gaussian noise. The ALE output is shown to be the sum of two uncorrelated components, one arising from optimum finite-lag Wiener filtering of the narrowband input components, and the other arising from the misadjustment error associated with the adaptation process. General expressions are given for the output autocorrelation function and power spectrum with arbitrary narrowband input signals, and the case of a single sinusoid in white noise is worked out as an example. Finally, the significance of these results to practical applications of the ALE is mentioned. Author (GRA)

N78-27335# Department of the Army, Alexandria, Va. Dept. of Electrical Engineering.

A METHOD FOR UTILITY LOAD MANAGEMENT USING SHORT TERM LOAD FORECASTING M.S. Thesis - Vermont Univ. Final Report
Robert Brian Ottesen 4 May 1978 188 p refs
(AD-A054005) Avail: NTIS HC A09/MF A01 CSCL 20/3

Several models for forecasting short term utility system loads are examined. A hybrid linear model is developed and used to simulate improvements to a utility load factor by providing the basis for scheduling deferred loads test. Results of simulations for 1976-1977 on a Vermont utility yielded average hourly forecast errors of 5%. Author (GRA)

N78-27336# Naval Postgraduate School, Monterey, Calif.
AN ADAPTIVE RECURSIVE FILTER M.S. Thesis
Soon-Ju Ko Dec. 1977 109 p refs
(AD-A053852) Avail: NTIS HC A09/MF A01 CSCL 09/3

An adaptive recursive digital filter is presented in which feedback and feedforward gains are adjusted adaptively to minimize a least square performance function on a sliding window averaging process. A two-dimensional version of the adaptive filter is developed and its performance compared with the optimal Wiener filter. The filter is shown to be effective in separating three diagonal trajectory streaks from a background of correlated noise added to white noise. Although the recursive adaptive filter approaches the optimal Wiener filter in performance, it does not require a priori statistical knowledge as does the Wiener filter to which it is compared. The results indicate that the recursive adaptive filter learns the statistics and adapts. Author (GRA)

N78-27337# Naval Avionics Facility, Indianapolis, Ind.
AN INDUSTRY SURVEY ON MANAGING THE TIMELY INTRODUCTION AND UTILIZATION OF LARGE SCALE INTEGRATED CIRCUITS IN MILITARY AVIONICS Final Report
Ronald R. Jennings 1 Mar. 1978 188 p
(AD-A053951; NAC-TR-2221) Avail: NTIS HC A09/MF A01 CSCL 05/1

This report presents the results of an industry survey coordinated by the Naval Avionics Center to obtain information on issues involved in managing the timely introduction and utilization of large scale integrated (LSI) circuits in military avionics equipment. Responses were received from individuals in many companies representing semiconductor manufacturers, avionics equipment suppliers, and airframe contractors. The responses covered a wide range of issues involving LSI usage in military avionics, including LSI device introduction; device obsolescence; LSI specifications; testing and qualification; technologies needing Naval Air Systems Command development support; needed changes in MIL-specifications, standards, etc.; procurement practices; and standardization. Comments and suggestions receiving various degrees of concurrence among the respondents are identified and discussed. Detailed answers of the respondents to the survey questions are also included. Author (GRA)

N78-27338# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.
A THEORETICAL SEARCH FOR SUPER-VELOCITY SEMICONDUCTORS Annual Report, 1 Jan. - 31 Dec. 1977
M. A. Littlejohn, J. R. Hauser, and T. H. Glisson Jan. 1978 116 p refs
(Contract N00014-76-C-0480)
(AD-A053585) Avail: NTIS HC A06/MF A01 CSCL 20/12

This report presents the results of research on carrier transport in III-V semiconducting compounds and alloys and the performance of microwave devices fabricated from those compounds and alloys. Author (GRA)

N78-27339# Naval Ship Research and Development Center, Bethesda, Md. Systems Development Dept.
COST AND FEASIBILITY OF STANDARD ELECTRIC WINCH DRIVE Final Report
T. E. Mansfield and G. W. Turner Apr. 1978 78 p refs
(AD-A054001; DTNSRDC/SDD-78/2) Avail: NTIS HC A05/MF A01 CSCL 13/9

The cost and feasibility of electric winch drives for underway replenishment highline/spanwire winches is investigated. The winch drives of interest are those using Silicon Controlled Rectifier (SCR) solid state motor controls. Service requirements including performance parameters and reliability/maintainability requirements are identified. Candidate electric drive systems are the dc Motor/Controller system and the ac Motor/Controller system. The latter type is further broken down into Voltage Source, Current Source, and Pulse Width Modulation systems. Each is described and their principal features, availability, and reliability/maintainability are discussed. The dc System uses a motor that is larger, more complex, and less reliable than the ac System. With the requirement for regenerative operation, the dc and ac Systems controllers are quite similar in design complexity and number of components. The Current Source/Slip Regulated ac Drive System is concluded to be superior for winch service since it best satisfies the critical regeneration and overload requirements, and uses the most rugged and reliable drive motor. Author (GRA)

N78-27340# General Electric Co., Schenectady, N. Y.
MODELING OF III-V FIELD EFFECT TRANSISTORS Final Scientific Report, 1 Oct. 1976 - 30 Sep. 1977
S. P. Yu and W. Tantraporn Mar. 1978 32 p refs
(Contract F44620-76-C-0043; AF Proj. 2305)
(AD-A053808; SRD-78-036; AFOSR-78-0706TR) Avail: NTIS HC A03/MF A01 CSCL 09/1

A two dimensional time domain computer program was formulated for investigating device physics of III-V field effect transistors. The device dynamics were deduced from the large signal time step impulse response. The computed cut-off frequency and intransic switching delay time as functions of gate length agree well with published data. The detailed internal carrier and potential distribution indicate persistent Gunn oscillation and significant current flow in the substrate for devices with small gate length to channel width ratios. GRA

N78-27341# Los Alamos Scientific Lab., N. Mex.
RESULTS OF RESEARCH INTO SUPERCONDUCTING SWITCHES WITH HIGH SPECIFIC SWITCHING CAPACITY
V. A. Glukhikh, A. I. Kostenko, N. A. Monoszon, V. A. Tishenko, and G. V. Trokhachov 1977 9 p refs Transl. into ENGLISH of unidentified Russion paper Presented at All Union Conf. on Eng. Probl. of Thermonucl. Reactors, Leningrad, 28-30 Jun. 1977
(Contract W-7405-eng-36)
(LA-TR-78-13; Conf-7706118-1) Avail: NTIS HC A02/MF A01

An attempt was made to clarify the reasons for instability and degradation of current and also for a determination of possible means of increasing the current-carrying capacity of superconducting switches. Several experimental switches were prepared with various widths of foils and various methods of holding the switches together. Two had mechanical bonding while the remainder were impregnated with epoxy resin. ERA

N78-27342# Oak Ridge Y-12 Plant, Tenn. Instrumentation and Characterization Dept.
PHASE-INSENSITIVE DETECTORS FOR ac RESISTANCE BRIDGES WITH APPLICATION TO TEMPERATURE CONTROL SYSTEMS
M. G. Duncan 28 Sep. 1977 11 p ref Presented at the IEEE Region 2 Conf. and Exhibit, Atlanta, 10 Apr. 1978
(Contract W-7405-eng-26)
(Y/DA-7468; Conf-780404-1) Avail: NTIS HC A02/MF A01

A method of detecting ac resistance bridge error signals with low sensitivity to stray reactances is presented. The detector, which compares magnitudes of two bridge signals, can be used in a fast resistance temperature control to maintain constant resistance to better than 2ppM at resisitances down to 5 milliohms. ERA

N78-27343# Texas Univ., Austin. Center for Electromechanics.
DESIGN, FABRICATION, AND TESTING OF A FAST DISCHARGE HOMOPOLAR MACHINE (FDX)
J. H. Gully, M. D. Driga, B. Grant, H. G. Rylander, K. M. Tolk, W. F. Weldon, and H. H. Woodson 1977 5 p ref Presented at the 7th Symp. on the Fusion Research Project, Knoxville,

Tenn., 25 Oct. 1977 Sponsored in part by the Electric Power Research Inst.
(Contract EG-77-S-05-5594)
(CONF-771029-117) Avail: NTIS HC A02/MF A01

The fast discharge experiment (FDX) is a 0.36 MJ, 200 V homopolar machine designed to discharge in one millisecond. All components, including dual brush actuation systems, a room-temperature A-t pulsed copper coil, two aluminum rotors with copper slip rings, low inductance return conductors, coaxial transmission line, four fast closing (30 mu sec), megamp switches, hydrostatic journal bearings, squeeze film thrust bearings and a fiberglass reinforced epoxy structure were fabricated and assembled. The detail design of machine components is presented. Preliminary testing, including rotor spin-ups, brush actuation, switch making, and pulsed field coil tests were concluded. A low speed, short-circuit discharge of FDX were conducted. Experimental data from these tests are compared with theoretical predictions. ERA

N78-27344# Addis Translations International, Portola Valley, Calif.
HIGH-VOLTAGE HIGH-CURRENT BREAKER AND CLOSER FOR POWER SYSTEMS WITH INDUCTIVE STORAGE DEVICES
E. A. Azizov Nov. 1977 6 p Transl. into ENGLISH from report by Inst. Atomnoi Energii (Moscow), IAE-2673, 1976 6 p Prepared for California Univ., Lawrence Livermore Lab. Sponsored by DoE
(UCRL-Trans-11310) Avail: NTIS HC A02/MF A01

A high voltage high current explosive circuit breaker and a high voltage high current mechanical circuit closer were worked out for use in the energy extraction blocks of high power sources and power supply systems of thermonuclear units, based on inductive storage devices with energy storage of 10 to the 7th power to 10 to the 8th power. General views of the circuit breakers were shown and described. ERA

N78-27345# Okonite Co., Ramsey, N. J.
DEVELOPMENT OF A HIGH VOLTAGE dc CABLE Final Report
R. A. LaBozetta Jan. 1978 84 p refs
(EPRI Proj. 7818)
(EPRI-EL-606) Avail: NTIS HC A05/MF A01

As has long been recognized, there are certain advantages to be gained by the use of high voltage dc systems to transport large blocks of power across long distances. Compared to ac power cables of the high pressure, oil-filled type in widespread use today, there is less dielectric loss and no skin effect loss in the dc cable. The dc cables can be used to connect frequency-dissimilar ac systems and are practical in situations where reactor compensation of ac systems is not feasible, as in long submarine lengths. In recent years therefore an increasing interest has been generated in determining whether the utilization of HVDC systems might provide technical or economical alternatives to extra high voltage ac transmissions. The scope of Okonite's investigation into the theory of HVDC cable design is outlined. Research was primarily in three areas--one involving the study of various dielectrics as possible candidates for future HVDC cable insulations, a second concerned with dc voltage evaluation of existing dielectrics, and a third to develop a method for determining the stress distribution in a dc cable. ERA

N78-27346# Brookhaven National Lab., Upton, N. Y.
HIGH PRECISION SUPERCONDUCTING MAGNETS
J. Allinger, G. Danby, J. Jackson, and A. Prodell 1977 4 p refs Presented at Particle Accelerator Conf., Chicago, 16 Mar. 1977
(Contract EY-76-C-02-0016)
(BNL-22556; Conf-770313-138) Avail: NTIS HC A02/MF A01

Window-frame type superconducting dipole magnets have demonstrated accuracy and predictability of fields which compare well with the best conventional accelerator-type magnets. Precision measurements were made on the two series powered 2 m long 4 T modules comprising the 8 deg bending magnet after two years of beam operation, including several dozen beam induced quenches. The integral field of the two units is identical to measurement accuracy, < or = to .0001 parts at approximately full aperture, for all multipoles except quadrupole. A 1 m long 6 T model of more advanced design shows pure dipole field, at all field levels, to .0001 parts, using a single correction coil with predetermined excitation. The field shape at approximately 0.5 T/sec rise rate is identical to dc. The advantages of the extended current sheet coil construction are discussed. Results are compared with computer simulations of construction errors. Suitable conceptual designs of compact 6 T dipoles and of quadrupoles applied to a 1 km accelerator lattice are presented. ERA

N78-27347# Argonne National Lab., Ill.
PROTECTION OF NEUTRAL-BEAM ACCELERATOR ELECTRODES FROM SPARK DISCHARGES
W. F. Praeg 1977 8 p refs Presented at 7th Symp. on Fusion Res. Project, Knoxville, Tenn., 25 Oct. 1977
(Contract W-31-109-eng-38)
(CONF-771029-183) Avail: NTIS HC A02/MF A01

The high voltage (HV) electrodes of neutral beam sources (NBS's) must be protected from occasional sparks to ground. Spark currents can be limited with special transformers and reactors which introduce time delays that are long enough former (STDT) connected in series with the HV power supply detects spark faults and limits the current supplied by the power supply and its capacitance to ground; it also initiates spark quenching. Nonsaturated, longitudinal reactors limit the discharge current supplied by the energy stored in the circuit capacitance of the NBS filament and arc power supplies long enough to discharge this capacitance into a resistor. The design principles of these protective circuits are presented. ERA

N78-27348# National Technical Information Service, Springfield, Va.
IMPATT DIODES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Mar. 1978
William E. Reed Apr. 1978 175 p Supersedes NTIS/PS-77/0354; NTIS/PS-76/0356;NTIS/PS-75/149
(NTIS/PS/78/0380/2; NTIS/PS-77/0354; NTIS/PS-76/0356; NTIS/PS-75/149) Avail: NTIS HC $28.00/MF $28.00 CSCL 09A

Government-sponsored research reports are cited covering the design, characterization, and applications of IMPATT diodes. Topics include reliability, power handling, properties, noise, fabrication, and radiation effects. Studies are included on the use of silicon and gallium arsenide IMPATT diodes for microwave generation and amplification. (This updated bibliography contains 170 abstracts, 19 of which are new entries to the previous edition.) GRA

N78-27349# National Technical Information Service, Springfield, Va.
IMPATT DIODES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1975 - Mar. 1978
William E. Reed Apr. 1978 251 p Supersedes NTIS/PS-77/0355; NTIS/PS-76/0357
(NTIS/PS-78/0381; NTIS/PS-77/0355; NTIS/PS-76/0357) Avail: NTIS HC $28.00/MF $28.00 CSCL 09A

Worldwide research reports on the properties, design, and utilization of IMPATT diodes are cited. Topics include reliability, characterization, power handling, mathematical analysis. Topics cover characterization, fabrication, reliability, noise, and mathematical analysis. The use of silicon and gallium arsenide diodes in microwave generation and amplification is included. ERA

N78-27350# National Technical Information Service, Springfield, Va.
BEAM LEAD MICROELECTRONICS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Mar. 1978
William E. Reed Apr. 1978 125 p Supersedes NTIS/PS-77/0362; NTIS/PS-76/0349
(NTIS/PS-78/0369/5; NTIS/PS-77/0362; NTIS/PS-76/0349) Avail: NTIS HC $28.00/MF $28.00 CSCL 09E

Research reports from worldwide literature are cited which treat with the technology and applications of beam lead devices. Topics include chip interconnections, design, fabrication, bonding, packaging, and testing. GRA

N78-27351# National Technical Information Service, Springfield, Va.
TRANSFERRED ELECTRON DEVICES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Mar. 1978
William E. Reed Apr. 1978 210 p Supersedes NTIS/PS-77/0258, and NTIS/PS-76/0273
(NTIS/PS-78/0363/8; NTIS/PS-77/0258; NTIS/PS-76/0273) Avail: NTIS HC $28.00/MF $28.00 CSCL 09A

The application of transferred electron devices to microwave oscillation, amplification, and switching is included in these reports from worldwide research. The physics of the transferred electron effect is discussed. Design, fabrication, and properties of transferred electron devices are also included. (This updated bibliography contains 203 abstracts, 26 of which are new entries to the previous edition.) GRA

N78-27352# Naval Research Lab., Washington, D. C.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: AUTOMATED SCANNING LOW-ENERGY ELECTRON PROBE (ASLEEP) FOR SEMICONDUCTOR WAFER DIAGNOSTICS Final Report
A. Christou Apr. 1978 42 p refs Sponsored in part by ARPA
(Contracts NBS-5-01718; NBS-711782)
(PB-279065/7; NBS-SP-400-30; LC-78-2200) Avail: NTIS HC A03/MF A01 CSCL 13H

Experiments designed to explore the measurement capabilities of ASLEEP for measurements on silicon, gallium arsenide, and indium phosphide are described. Four areas were emphasized: (1) semiconductor resistivity, (2) semiconductor defect density; (3) lateral inhomogeneities, and (4) oxide uniformity. Although oxide charging problems limited the utility of ASLEEP in its present form for silicon, defects and lateral inhomogenieties could be readily detected in gallium arsenide and indium phosphide. GRA

N78-27353# National Bureau of Standards, Washington, D. C. Electronic Technology Div.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: MICROELECTRONIC TEST PATTERN NBS-4
W. Robert Thurber and Martin G. Buehler Apr. 1978 70 p refs
(ARPA Order 2397)
(PB-279089/7; NBS-SP-400-32; LC-78-606024) Avail: NTIS HC A04/MF A01 CSCL 09A

Microelectronic evaluation of the resistivity-dopant density relationship in silicon is considered. The NBS-4 pattern contains 38 test structures such as planar four-probe resistors, sheet resistors, MOS capacitors, p-n junctions, bipolar and MOS transistors, Hall effect device, and process control structures. The overall pattern is a square 5.08 on a side and is divided into four quadrants which are separated by scribe lines. A detailed layout of each structure is presented including both a top view and a cross sectional view. Photomicrographs of each quadrant and the quadrants of the six masks used in the fabrication of the pattern are shown in an appendix. GRA

N78-27354# Colorado Univ., Boulder. Dept. of Electrical Engineering.
HIGHER ORDER MODES IN RECTANGULAR COAXIAL LINE WITH INFINITELY THIN INNER CONDUCTOR
John C. Tippet and David C. Change Mar. 1978 41 p refs (Contract NBS-CST-8393)
(PB-279054/1; NBSIR-78-873) Avail: NTIS HC A03/MF A01 CSCL 09A

The singular integration approach is used to derive the secular equations for both TE and TM waves in a rectangular coaxial line with zero thickness inner conductor. Approximations for the secular equations are found that reduce to simple expressions in terms of well-known special functions elliptic integrals). When the strip width is exceedingly small or nearly equal to the width of the outer conductor, closed form expressions for the cut-off frequencies can be found by replacing the elliptic integrals by their asymptotic forms for modulus either near zero or one. GRA

N78-28036# Joint Publications Research Service, Arlington, Va.
HOW TO REDUCE RADIO INTERFERENCE FROM HIGH-VOLTAGE ELECTRIC POWER TRANSMISSION LINES
V. V. Kapitonov and Yu. M. Abramson *In its* Transl. on USSR Sci. and Technol. (JPRS-71393) 30 Jun. 1978 p 22-25 Transl. into ENGLISH from Tekhn. i Nauka (Moscow), no. 2, Feb. 1978 p 33-34 (For primary document see N78-28033 18-99)
Copyright. Avail: NTIS HC A05/MF A01

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N78-27355 Princeton Univ., N. J.
THE TRANSIENT THREE DIMENSIONAL TRANSPORT OF LIQUID AND HEAT IN FRACTURED POROUS MEDIA Ph.D. Thesis
Kevin ONeill 1978 451 p
Avail: Univ. Microfilms Order No. 7807488

The behavior of the temperature fronts in three dimensions in both the isotropic and anisotropic cases investigated differs in some important respects from that in the one dimensional cases. In the three dimensional cases, after an initial separation of the fronts and the development of relatively large temperature differences between the two flow regimes, the spatial gap between the fronts closes and the maximum temperature difference declines. Examination of the expression for terminal front separation in the one dimensional case suggests a reason for this: the lower difference between the fracture and pore fluid velocities in regions distant from the injection point could not support the initially developed front separations. As in the one dimensional cases, in all three dimensional cases the temperature solutions exhibit a characteristic disproportionate spreading in the lower portion of each front. Dissert. Abstr.

N78-27356 Tennessee Univ., Knoxville.
DESIGN THEORY FOR VENTURI SCRUBBER PERFORMANCE Ph.D. Thesis
Jerry Wayne Crowder 1977 116 p
Avail: Univ. Microfilms Order No. 7807689

The performance model was validated with available experimental data for a range of throat gas velocities, liquid-to-gas ratios and particle diameters and is used to study the heretofore undocumented effect on collection efficiency of several design parameters. Most striking among the discoveries is the prediction of little effect on collection efficiency with increasing values of liquid-to-gas ratio above about 15 gallons per thousand cubic feet. A graphical procedure for determining the value of design parameters, including a newly defined minimum contactor length, necessary for the collection of log-normally distributed particles at a desired efficiency is presented. A simplified form of the theoretical model is developed that includes the new design parameter of minimum contactor length, but does not require numerical equipment to evaluate. Dissert. Abstr.

N78-27357* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DIRECT HEATING SURFACE COMBUSTOR Patent
Donald G. Beremand, Lloyd I. Shire, and Thaddeus S. Mroz, inventors (to NASA) Issued 9 May 1978 6 p Filed 26 Jul. 1976 Supersedes N76-28646 (14 - 19, p 2478)
(NASA-Case-LEW-11877-1; US-Patent-4,087,962; US-Patent-Appl-SN-708660; US-Patent-Class-60-39.65; US-Patent-Class-431-7; US-Patent-Class-431-10; US-Patent-Class-431-328; US-Patent-Class-60-39.69R) Avail: US Patent Office CSCL 20D

The combustor utilizes a non-adiabatic flame to provide low-emission combustion for gas turbines. A fuel-air mixture is directed through a porous wall, the other side of which serves as a combustion surface. A radiant heat sink disposed adjacent to and spaced from the combustion surface controls the combustor

flame temperature in order to prevent the formation of oxides of nitrogen. A secondary air flow cools the heat sink. Additionally, up to 100% of secondary air flow is mixed with the combustion products at the direct heating surface combustor to dilute such products thereby reducing exit temperature. However, if less than 100% secondary air is mixed to the combustor, the remainder may be added to the combustion products further downstream.
Official Gazette of the U.S. Patent Office

N78-27358 Clarkson Coll. of Technology, Potsdam, N.Y.
TWO-PHASE IMMISCIBLE FLOW THROUGH POROUS MEDIA Ph.D. Thesis
Roberto Francisco Mezzomo 1977 255 p
Avail: Univ. Microfilms Order No. 780452

An experimental program was set up for the determination of capillary pressure and relative permeability relationships for porous materials. This information was used for testing the predictive capabilities of a mathematical model for two-phase flow through porous media. Two pieces of equipment were developed for this purpose. One was a variant of Hewitt's original mercury Porosimeter/Permeameter for the determination of capillary pressure curves and the non-wetting phase relative permeability curve for the case of a completely displaceable wetting phase (zero wetting phase residual saturation). A second apparatus, a liquid/gas permeameter was built to measure both wetting and non-wetting phase relative permeabilities in the drainage cycle. Dissert. Abstr.

N78-27359 Brown Univ., Providence, R. I.
PRECISE MEASUREMENT OF THE THERMAL CONDUCTIVITY OF GASES BY TRANSIENT HOT-WIRE METHOD Ph.D. Thesis
Heros Sookiazian 1977 201 p
Avail: Univ. Microfilms Order No. 78-09097

A high-precision instrument to measure the thermal conductivity of gases up to 800 C and 400 atm in an absolute way is described. The instrument works on the hotwire principle with a five micron platinum wire, and operates in the transient regime thus eliminating completely the effects of natural convection. The design parameters combined with an end-effects compensator ensure that the instrument performs almost exactly like a line source in an infinite fluid, thus permitting us to calculate the thermal conductivity from the slope of a Delta T log t diagram on which 36-42 conjugate pairs of these quantities have been determined with great precision. Measurements on the noble gases He, Ne, Ar, Kr and Xe combined with our best measurements of viscosity, all extrapolated to rho = 0, yield Eucken factors at 300 K which do not differ from the theoretical value by more than 0.4%. Dissert. Abstr.

N78-27360 Colorado State Univ., Fort Collins.
HEAT TRANSFER IN PACKED BEDS AT LOW REYNOLDS NUMBER Ph.D. Thesis
Francis Coyne Prenger, Jr. 1977 83 p
Avail: Univ. Microfilms Order No. 78-07437

At low Reynolds number flows through beds of fine particles, the gas temperature and solids temperature differ substantially. An analytical model is proposed which treats this mechanism and is consistent with experimental results. Experimental results were obtained using air flowing through packed beds of sodium chloride and calcium chloride. Four heat transfer parameters were identified: bed thermal conductivity, heat transfer coefficient between the interstitial gas and the solids, and two heat-transfer coefficients for the coolant tubes, one between the coolant tubes and the interstitial gas and one between the coolant tubes and the solid particles. Each coefficient is presented in terms of a single correlating parameter. A comparison between the analytical model and the test data selected cases is also included. Dissert. Abstr.

N78-27361 Virginia Polytechnic Inst. and State Univ., Blacksburg.
NEAR-WALL SIMILARITY IN THREE-DIMENSIONAL TURBULENT BOUNDARY LAYERS Ph.D. Thesis
Mark Harris Tennant 1977 416 p
Avail: Univ. Microfilms Order No. 78-08121

A comprehensive set of data was measured for the three dimensional case of plane, incompressible, turbulent boundary layer flow around a vertical cylinder with a trailing edge. Included were over one hundred direct measurements of wall shear stress using a specially designed, omnidirectional, floating element device, over thirty corresponding velocity profiles, and the neighboring static pressure field. Using these data, comparisons were made among nine near-wall similarity models. Evidence from these comparisons tends to support the hypothesis of three-dimensional near-wall similarity, at least for regions moderately remote from separation. Dissert. Abstr.

N78-27362 Stanford Univ., Calif.
FULL-COVERAGE FILM COOLING: THE 3-DIMENSIONAL MEASUREMENTS OF TURBULENCE STRUCTURE AND PREDICTION OF RECOVERY REGION HYDRODYNAMICS Ph.D. Thesis
Savas Yavuzkurt 1978 132 p
Avail: Univ. Microfilms Order No. 78-08869

Hydrodynamic measurements were made with a triaxial hot-wire in the full coverage region and the recovery region following an array of injection holes inclined downstream, at 30 deg to the surface. The data were taken under isothermal conditions at ambient temperatures and pressure for two blowing ratios: M = 0.9 and M = 0.4. (M = rho sub jet U sub jet/rho sub infinity U sub infinity, where U is the mean velocity and rho is the density. Subscripts jet and infinity stand for injectant and free stream, respectively.) High turbulent kinetic energy (TKE) levels were found for low blowing, with low TKE levels for high blowing. A one-equation model of turbulence (using TKE with an algebraic mixing length) was used with a 2-D computer program to predict the mean velocity and TKE profiles in the recovery region. A hot-wire scheme was developed to make measurements in the three dimensional turbulent boundary layer over the full coverage surface. Dissert. Abstr.

N78-27363*# Stanford Univ., Calif. Thermosciences Div.
HEAT TRANSFER TO A FULL-COVERAGE, FILM-COOLED SURFACE WITH COMPOUND-ANGLE (30 DEG AND 45 DEG) HOLE INJECTION
H. K. Kim, R. J. Moffat, and W. M. Kays Mar. 1978 163 p refs
(Contract NAS3-14336)
(NASA-CR-157299; SU-HMT-28) Avail: NTIS HC A08/MF A01 CSCL 20M

An experimental study of heat transfer was conducted on a turbulent boundary layer with full coverage film cooling through an array of holes inclinded at 30 degrees to the surface and 45 degrees to the flow direction (compound-angle injection). Heat transfer coefficients, based on (t sub wall - t sub stream), were measured over a range of injectant flow (M = 0 to M = 1.5) and Reynolds numbers (160,000 less than or equal to Re sub x less than or equal to 2,500,000) at velocities between 9.8 and 16.8 m/s. Stanton numbers are defined using the difference between wall temperature and stream temperature as the potential difference. Data are presented for injectant temperatures equal to the wall temperature and injectant temperature equal to the stream temperature. Superposition can be used to predict the Stanton number for any intermediate temperature. Author

N78-27364*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN EXPERIMENTAL DOCUMENTATION OF PRESSURE GRADIENT AND REYNOLDS NUMBER EFFECTS ON COMPRESSIBLE TURBULENT BOUNDARY LAYERS
M. I. Kussoy, C. C. Horstman, and M. Acharya Jun. 1978 114 p refs
(NASA-TM-78488; A-7426) Avail: NTIS HC A06/MF A01 CSCL 20D

Attached supersonic turbulent boundary layers, with a wide range of adverse pressure gradient strengths, are investigated for Reynolds numbers from 11.7 x 1 million to 314 x 1 million. Surface pressure and surface shear measurements were obtained for six flow fields over the entire Reynolds number range. In addition, two flow fields - one with a moderate pressure gradient and the other with a severe pressure gradient - are thoroughly documented at a single Reynolds number. This experimental documentation includes both mean and fluctuating profiles throughout the flow field, and is sufficient to define the complete flow field, including the upstream undisturbed flow region. G.G.

N78-27365*# National Aeronautics and Space Administration, Washington, D. C.
INTEGRAL METHOD FOR THE CALCULATION OF THREE-DIMENSIONAL, LAMINAR AND TURBULENT BOUNDARY LAYERS Final Report
H. W. Stock Jul. 1978 134 p refs Transl. into ENGLISH of West German report BMVC-Vertag nr. T/RF-410/51-154, Rept-77/51-B, Oct. 1977 129 p Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Dornier-Werke G.m.b.H., Friedrichshafen (West Germany)
(NASA-TM-75320) Avail: NTIS HC A07/MF A01 CSCL 20D

The method for turbulent flows is a further development of an existing method; profile families with two parameters and a lag entrainment method replace the simple entrainment method and power profiles with one parameter. The method for laminar flows is a new development. Moment of momentum equations were used for the solution of the problem, the profile families were derived from similar solutions of boundary layer equations. Laminar and turbulent flows at the wings were calculated. The influence of wing tapering on the boundary layer development was shown. The turbulent boundary layer for a revolution ellipsoid is calculated for 0 deg and 10 deg incidence angles. G.G.

N78-27366*# Martin Marietta Aerospace, Denver, Colo.
SILVER-TEFLON CONTAMINATION UV RADIATION STUDY Final Report
J. A. Muscari 9 Jun. 1978 66 p refs
(Contract NAS9-15436)
(NASA-CR-151738; MCR-78-567) Avail: NTIS HC A04/MF A01 CSCL 20D

Silver-Teflon (Ag/FEP) is planned to be used as the thermal control material covering the radiator surfaces on the shuttle orbiter payload bay doors. These radiators require the use of materials that have a very low solar absorptance and a high emittance for heat rejection. However, operationally, materials used on these critical radiator surfaces, such as silver-Teflon, will be exposed to a variety of conditions which include both the natural as well as the induced environments from the Shuttle Orbiter. A complete test facility was assembled, and detailed test procedures and a test matrix were developed. Measurements of low solar absorptance were taken before and after contamination, at intervals during irradiation, and after sample cleaning to fulfill all the requirements. B.B.

N78-27367*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOME FLOW PHENOMENA IN A CONSTANT AREA DUCT WITH A BORDA TYPE INLET INCLUDING THE CRITICAL REGION
R. C. Hendricks and R. J. Simoneau 1978 14 p refs Proposed for Presentation at the Winter Ann. Meeting, San Francisco, 10-15 Dec. 1978; Sponsored by ASME
(NASA-TM-78943; E-9690) Avail: NTIS HC A02/MF A01 CSCL 20D

Mass limiting flow characteristics for a 55 L/D tube with a Borda type inlet were assessed over large ranges of temperature and pressure, using fluid nitrogen. Under certain conditions, separation and pressure drop at the inlet was sufficiently strong to permit partial vaporization and the remaining fluid flowed through the tube as if it were a free jet. An empirical relation was determined which defines conditions under which this type of flow can occur. A flow coefficient is presented which enables estimations of flow rates over the experimental range. A flow rate stagnation pressure map for selected stagnation isotherms and pressure profiles document these flow phenomena. J.A.M.

N78-27368*# Tennessee Univ., Knoxville. Dept. of Engineering Science and Mechanics.
A HIGH ORDER ACCURATE FINITE ELEMENT ALGORITHM FOR HIGH REYNOLDS NUMBER FLOW PREDICTION Final Technical Report
Allen J. Baker 16 Jun. 1978 106 p refs
(Grant NsG-1391)
(NASA-CR-157309) Avail: NTIS HC A06/MF A01 CSCL 20D

A Galerkin-weighted residuals formulation is employed to establish an implicit finite element solution algorithm for generally nonlinear initial-boundary value problems. Solution accuracy, and convergence rate with discretization refinement, are quantized in several error norms, by a systematic study of numerical solutions to several nonlinear parabolic and a hyperbolic partial differential equation characteristic of the equations governing fluid flows. Solutions are generated using selective linear, quadratic and cubic basis functions. Richardson extrapolation is employed to generate a higher-order accurate solution to facilitate isolation of truncation error in all norms. Extension of the mathematical theory underlying accuracy and convergence concepts for linear elliptic equations is predicted for equations characteristic of laminar and turbulent fluid flows at nonmodest Reynolds number. The nondiagonal initial-value matrix structure introduced by the finite element theory is determined intrinsic to improved solution accuracy and convergence. A factored Jacobian iteration algorithm is derived and evaluated to yield a consequential reduction in both computer storage and execution CPU requirements while retaining solution accuracy. A.R.H.

N78-27369# Detroit Diesel Allison, Indianapolis, Ind. Detroit Diesel Allison Div.
RESEARCH ON AEROELASTIC PHENOMENA IN AIRFOIL CASCADES AN EXPERIMENTAL INVESTIGATION OF THE UNSTEADY AERODYNAMIC OF A CLASSICAL AIR FOIL CASCADE IN TRANSLATION
Sanford Fleeter, Ronald E. Riffel, Thomas H. Lindsey, and Mark D. Rothrock Apr. 1978 62 p refs
(Contract N00014-72-C-0351)
(AD-A053931; EDR-9477) Avail: NTIS HC A04/MF A01 CSCL 20/4

The advent of high tip-speed, high work, blading in the fan stages of advanced gas turbine engines has led to the recognition of a new type of blading instability - unstalled supersonic flutter. As a result, a concerted effort to develop an appropriate predictive mathematical model has taken place. To determine the range of validity and to direct refinements to the basic flow model, fundamental supersonic oscillating cascade data are required. The experiment described herein is directed at significantly extending the range of existing supersonic cascade data to include translation mode oscillations. In particular, the fundamental time-variant translation mode aerodynamics are determined for the first time for a classical airfoil cascade in supersonic inlet flow field over a range of interblade phase angles at a realistic reduced frequency value. These unique experimental data are then correlated with predictions obtained from an appropriate state-of-the-art harmonically oscillating flat plate cascade aerodynamic analysis. Author (GRA)

N78-27370# California Univ., Livermore. Lawrence Livermore Lab.
SIMPLE CODE
W. P. Crowley, C. P. Hendrickson, and T. E. Rudy 1 Feb. 1978 36 p refs
(Contract W-7405-eng-48)
(UCID-17715) Avail: NTIS HC A03/MF A01

An introduction to computational fluid dynamics and heat flow is presented. To do this, a two dimensional Langrangian formulation of the equations of inviscid compressible hydrodynamics and simple heat conduction was considered. A tabular ideal gas equation of state was provided for determination of the relations between the state variables. The equations of hydrodynamics and heat conduction were solved by finite difference methods. Each physical process was treated in a separate section with the physical equations stated and the difference equations derived. ERA

N78-27371# Solar, San Diego, Calif.
DEVELOPMENT OF A CERAMIC TUBE HEAT EXCHANGER WITH RELAXING JOINT Monthly Technical Progress Report, 1 Nov. - 1 Dec. 1977
Michael E. Ward and James C. Napier 10 Dec. 1977 27 p
(Contract EF-77-C-01-2556)
(FE-2556-11) Avail: NTIS HC A03/MF A01

High temperature radial compression tests were conducted on sintered silicon and super KT silicon carbide (Carborundum). A glass relaxing, joint relaxation, deflection test was completed. Results show negligible increase in leakage. The glass joint was given a 500 hour thermal stability test. Gas tight permanent

joints were made using tube sleeve silicon joint. Ceramic heat exchanger ceramic to metal joint was described detail. ERA

N78-27372# Los Alamos Scientific Lab., N. Mex.
GENERAL ANALYSIS AND ILLUSTRATIVE EXAMPLES OF FREE DRAINAGE OF NEWTONIAN AND NON-NEWTONIAN FILMS WITH TIME-DEPENDENT RHEOLOGICAL PARAMETERS
J. H. Pendergrass 1977 25 p refs Presented at the Southeastern Seminar on Thermal Sci. Raleigh, N. C., 6-7 Apr. 1978
(Contract W-7405-eng-36)
(LA-UR-77-2014; Conf-780408-1) Avail: NTIS HC A02/MF A01

Analyses relatively general with respect to rheological model characteristics are presented for thickness, holdup, and drainage rate as functions of time and position for Newtonian and nonNewtonian films with time variable rheological properties during free drainage from flat plates with negligible inertial and interfacial tension forces. The general theory was illustrated by several specific examples involving chemical reaction and heat transfer. ERA

N78-27373# Brookhaven National Lab., Upton, N. Y.
BEHAVIOR OF CONDITIONED VARIABLES IN FREE TURBULENT SHEAR FLOWS
Edward E. OBrien (State Univ. of N. Y., Stonybrook) and Cesar Dopazo 1977 14 p refs Presented at Symp. on Turbulence, Berlin, 1 Aug. 1977
(Contract EY-76-C-02-0016; Grant NSF ENG-7621917)
(BNL-23078; Conf-770876-1) Avail: NTIS HC A02/MF A01

Work on the conservation equations for conditioned mean variables in turbulent shear flows was extended to obtain the evolution equation for the conditioned probability density function of a scalar field which is distributed intermittently in the flow. The equation was applied to the similarity regime of a two dimensional turbulent wake at 400 diameters down stream, where extensive conditioned moment measurements are available. The asymptotic forms of the density function were found for low and high intermittency regions, and they agree with experimental data. In particular, a connection was established between the rate of entrainment of scalar-free fluid into the scalar zone and the pdf of the scalar at small positive values. The conditioned mean and variance of the scalar field are deduced and are also shown to be compatable with existing experimental data. ERA

N78-27374# Hanford Engineering Development Lab., Richland, Wash.
TURBULENT HYDRAULIC PENETRATION FROM TURBULENT PIPE FLOW INTO STAGNANT COLUMNS Ph.D. Thesis - Washington State Univ., Pullman
G. R. Bloom Jan. 1978 113 p refs
(Contract EY-76-C-14-2170)
(TID-28198) Avail: NTIS HC A06/MF A01

The depth of mixing of water from turbulent pipe flow into a vertically oriented pipe deadleg or stagnant column was investigated. The depth of turbulent penetration or mixing length was correlated as a function of the piping system Reynolds number and kinematic viscosity. The dimensionless mixing length is defined as the depth of hydraulic mixing divided by the inside diameter of the deadleg. Water was pumped at flow rates between 40 1/min and 750 1/min through smooth tubing sections with inside diameters between 22 mm and 73 mm. Isothermal experimental runs were performed at water temperatures between 30 C and 80 C. ERA

N78-27375# Argonne National Lab., Ill.
TWO-PHASE FLOW MEASUREMENT BY PULSED NEUTRON ACTIVATION TECHNIQUES
P. Kehler Jan. 1978 195 p refs
(Contract W-31-109-eng-38)
(ANL-NUREG-CT-78-17) Avail: NTIS HC A09/MF A01

The pulsed neutron activation (PNA) technique for measuring the mass flow velocity and the average density of two-phase mixtures is described. PNA equipment can be easily installed at different loops, and PNA techniques are nonintrusive and independent of flow regimes. These features of the PNA technique make it suitable for in-situ measurement of two phase flows, and for calibration of more conventional two phase flow measurement devices. Analytic relations governing the various PNA methods are derived. The equipment and procedures used in the first air-water flow measurement by PNA techniques are discussed, and recommendations are made for improvement of future tests. In the present test, the mass flow velocity was determined with an accuracy of 2 percent, and average densities were measured down to 0.08 g/cu cm with an accuracy of 0.04 g/cu cm. Both the accuracy of the mass flow velocity measurement and the lower limit of the density measurement are functions of the injected activity and of the total number of counts. ERA

N78-27376# Sandia Labs., Albuquerque, N. Mex.
STEADY THERMAL CONVECTION AT LOW RAYLEIGH NUMBER FROM CONCENTRATED SOURCES IN POROUS MEDIA
C. E. Hickox, Jr. Dec. 1977 45 p refs
(Contract EY-76-C-04-0789)
(SAND-77-1529) Avail: NTIS HC A03/MF A01

Several simple mathematical models are proposed for the analysis of steady thermal convection from a concentrated source of heat in a fluid saturated porous medium. It is assumed that the Rayleigh number associated with the natural convection process is small enough so that the temperature distribution is determined by thermal conduction acting alone. Application of the results to the disposal of radioactive wastes in the seabed is discussed. ERA

N78-27377# Argonne National Lab., Ill.
BUBBLE DYNAMICS IN A SUPERHEATED LIQUID
W. T. Sha and V. L. Shah Sep. 1977 55 p refs
(Contract W-31-109-eng-38)
(ANL-77-20; NUREG-0333) Avail: NTIS HC A04/MF A01

A survey on bubble dynamics is presented. Growth of a single spherical bubble moving in a uniformly superheated liquid was considered. Equations of motion and energy are presented in the forms that take into consideration the interaction between the motion and the growth. The fourth order Runge-Kutta method was used to obtain a simultaneous solution of equations of motion and growth rate, and the solution was compared with available experimental results. Results for liquid sodium are presented for a range of pressures and Jakob numbers. ERA

N78-27378# Argonne National Lab., Ill.
SODIUM FLOW CALIBRATION USING A PULSED NEUTRON ACTIVATION TECHNIQUE ON A 400mm (16 INCH) PIPE AT LMEC
G. A. Forster and P. Kehler Nov. 1977 33 p refs
(Contract W-31-109-eng-38)
(ANL-CT-78-9) Avail: NTIS HC A03/MF A01

The velocity of liquid sodium in pipes can be measured by the pulsed neutron activation (PNA) technique without disturbing the pipe or removing insulation. A collimated beam of 14 MeV neutrons is directed against the sodium filled pipe. The resulting gamma activity is detected at a suitable distance downstream. The velocity is determined from the spacing of source and detector, and the transit time of the activated sodium weighted for gamma decay. Data were taken on the 400 mm sodium system at temperatures of 200, 400, and 560 C. The resulting velocities come within the 2 percent predicted uncertainty limit for the higher flow ranges when compared to the system's Venturi reference flowmeter. A low velocity measuring capability (.05 m/s) was also demonstrated. ERA

N78-27379# National Technical Information Service, Springfield, Va.
FLOW VISUALIZATION, VOLUME 1. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Mar. 1977
Guy E. Habercom, Jr. May 1978 276 p
(NTIS/PS-78/0425/5) Avail: NTIS HC $28.00/MF $28.00 CSCL 20D

Citations of Federally-funded research cover major studies concerning flow visualization for wind tunnel, water tunnel, and shock tube testing. The visualization methods described include the use of smoke, water vapor, dyes, oils, bubbles, phase change paints, and particles. While many of these studies cover flow visualization techniques for specific applications, they are included because of their applicability to various research problems.

Schlieren and shadowgraph photography and holographic techniques are excluded from this bibliography. GRA

N78-27380# National Technical Information Service, Springfield, Va.
FLOW VISUALIZATION, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Apr. 1977 - Mar. 1978
Guy E. Habercom, Jr. May 1978 89 p Supersedes NTIS/PS-77/0342; NTIS/PS-76/0334; NTIS/PS-75/116
(NTIS/PS-78/0426/3; NTIS/PS-77/0342; NTIS/PS-76/0334; NTIS/PS-75/116) Avail: NTIS HC $28.00/MF $28.00 CSCL 20D

For abstract, see N78-27379.

N78-27381# Ohio State Univ., Columbus. Dept. of Mechanical Engineering.
STEADY AND TRANSIENT NATURAL CONVECTION WITH VOLUMETRIC ENERGY SOURCES IN A FLUID LAYER BOUNDED FROM BELOW BY A SEGMENT OF A SPHERE Annual Report, Jul. 1976 - Sep. 1977
J. H. Min and F. A. Kulacki Mar. 1978 109 p refs
(Contract AT(49-24)-0149)
(PB-278535/0; NUREG-CR-0006) Avail: NTIS HC A06/MF A01 CSCL 18I

The natural convection is studied in an internally heated, single-phase fluid layer bounded from below by a segment of a sphere. Steady-state heat transfer coefficients are determined as a function of the Rayleigh number for a range of layer geometries. The thermal boundary conditions maintained were an insulated, rigid lower boundary and an isothermal, right upper boundary. As a model of a possible core-melt configuration, the present experiments provide heat transfer data in a situation wherein the convective transport process conservatively represents any single-phase convective process in the core melt when thermal radiation within the core melt is absent, and all of the heat flow is upward. GRA

N78-27382# Advisory Group for Aerospace Research and Development, Paris (France).
TECHNICAL EVALUATION REPORT OF THE FLUID DYNAMICS PANEL SYMPOSIUM ON LAMINAR-TURBULENT TRANSITION
Mark V. Morkovin (Illinois Inst. of Technol., Chicago) Jun. 1978 18 p refs Symp. held at Lyngby, Denmark, 2-4 May 1978
(AGARD-AR-122; ISBN-92-835-1283-9) Avail: NTIS HC A02/MF A01

The AGARD Fluid Dynamics Panel organized a three day symposium on laminar-turbulent transition to review the progress achieved during the last ten years and to bring to light the still unsolved problems. There were a total of twenty-nine papers presented in five sessions. The list of these papers heads the references at the end of the report. A second section of this report presents various considerations for evaluating theoretical and experimental analyses of the transition phenomena with particular concern to the improvement of methods for calculating (transition) onset and development on which emphasis was focused in the Call for Papers by the Program Committee. The subsequent sections then offer evaluative comments concerning individual papers and related groups of papers, primarily from the point of view of the specialist in the given subfield. G.Y.

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N78-27383 Pennsylvania State Univ., University Park.
EXPERIMENTAL CALIBRATION OF THE QUARTZ-MAGNETITE OXYGEN ISOTOPE GEOTHERMOMETER Ph.D. Thesis
William Frederick Downs 1977 155 p
Avail: Univ. Microfilms Order No. 7808349

Oxygen isotope analyses of the mineral and fluid phases were performed by extracting oxygen via standard bromine pentafluoride techniques and combusting the free oxygen to CO2. The oxygen isotopic fractionation between quartz and magnetite was measured directly by using CO2 gas produced from magnetite and quartz as the standard and sample gases, respectively. The calibration of the oxygen isotope geothermometer for quartz and magnetite resulting from this investigation was applied to published isotopic analyses of 131 igneous and metamorphic rocks. Dissert. Abstr.

N78-27384* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
REMOTE WATER MONITORING SYSTEM Patent
David C. Grana and David P. Haynes, inventors (to NASA) Issued 16 May 1978 11 p Filed 4 Aug. 1977 Supersedes N77-28563 (15 - 19, p 2548)
(NASA-Case-LAR-11973-1; US-Patent-4,089,209; US-Patent-Appl-SN-821681; US-Patent-Class-73-61R; US-Patent-Class-73-170A; US-Patent-Class-73-425.4R) Avail: US Patent Office CSCL 14B

A remote water monitoring system is described that integrates the functions of sampling, sample preservation, sample analysis, data transmission and remote operation. The system employs a floating buoy carrying an antenna connected by lines to one or more sampling units containing several sample chambers. Receipt of a command signal actuates a solenoid to open an intake valve outward from the sampling unit and communicates the water sample to an identifiable sample chamber. Such response to each signal receipt is repeated until all sample chambers are filled in a sample unit. Each sample taken is analyzed by an electrochemical sensor for a specific property and the data obtained is transmitted to a remote sending and receiving station. Thereafter, the samples remain isolated in the sample chambers until the sampling unit is recovered and the samples removed for further laboratory analysis.
Official Gazette of the U.S. Patent Office

N78-27385*# National Aeronautics and Space Administration. Pasadena Office, Calif.
VISCOSITY MEASURING INSTRUMENT Patent Application
Samuel P. Feinstein, inventor (to NASA) Filed 23 Jun. 1978 16 p
(Contract NAS7-100)
(NASA-Case-NPO-14501-1; US-Patent-Appl-SN-918535) Avail: NTIS HC A02/MF A01 CSCL 14B

An instrument for measuring the viscosity of coal samples at an elevated temperature such as 500F is presented when they partially decompose into gases, to aid in the design of equipment for feeding coal into combustion chambers. A preheated cylinder holds a coal sample while a preheated piston presses on the sample to force it through a narrow tube. The cylinder has a concave end wall while the piston has a convex end, to increase the surface area of contact with the sample to more rapidly heat the sample. The piston has a seal of compressed carbon material, which self sizes itself to the cylinder to form a seal therewith that prevents the escape of volatiles. NASA

N78-27386*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MEASUREMENT OF CONTROL SYSTEM RESPONSE USING AN ANALOG OPERATIONAL CIRCUIT
Vincent R. Lalli 1978 14 p refs Presented at the Elec./Electron. Conf. and Exposition, Cleveland, 9-11 May 1978; Sponsored by IEEE
(NASA-TM-78937; E-9680) Avail: NTIS HC A02/MF A01 CSCL 14B

Ten basic steps are established for an analog method that measures control system response parameters. An example shows how these steps were used on a speed control portion of an auxiliary power unit. The equations and calculations necessary to describe this subsystem are given. The mechanization schematic and simulation diagram for obtaining the measured response parameters of the control system using an analog circuit are

explained. Methods for investigating the various effects of the control parameters are described. It is concluded that the optimum system should be underdamped enough to be slightly oscillatory during transients. Author

N78-27387# Naval Research Lab., Washington, D. C.
PROCESSOR AIDED FIRE DETECTOR Interim Report
Thomas T. Street, John I. Alexander, and Frederick W. Williams
Dec. 1977 30 p refs
(ZF43451001)
(AD-A053845; AD-E000140; NRL-MR-3680) Avail: NTIS HC A03/MF A01 CSCL 13/12

A prototype multi-level blower assisted fire detection system has been developed. Specific principles of detection are adaptable to the detector housing depending on a particular need. The multi-level blower assisted feature increases the sensitivity above commercially available detectors. To reduce false alarms especially during changing environmental conditions such as would be encountered with shipboard applications a signal processor in the form of chip logic has been designed and adapted to the detector. The prototype system has been subjected to variety of small scale fire situations while being compared to other fire detectors. Author (GRA)

N78-27388# Naval Training Equipment Center, Orlando, Fla.
HOLOGRAPHIC TERRAIN SIMULATION Interim Report, May - Aug. 1977
Denis R. Breglia, Joseph F. Mulson, and Alfred H. Rodemann
Dec. 1977 41 p refs
(AD-A053472; NAVTRAEQUIPC-IH-295) Avail: NTIS HC A03/MF A01 CSCL 08/6

A feasibility analysis of a holographic terrain simulation concept is described. Experimental work in which photographs of terrain are holographically stored and then displayed is evaluated. Advantages of holographic storage of analog images include multiplexing capability of several images stored at one location and the advantage of displayed image stability from a moving hologram array. Future efforts and investigations are outlined. Author (GRA)

N78-27389# Ames Lab., Iowa.
LASER TWO-PROTON EXCITED FLUOROMETRIC DETECTION FOR HIGH PRESSURE LIQUID CHROMATOGRAPHY M.S. Thesis - Iowa State Univ.
M. J. Sepaniak Dec. 1977 58 p refs
(Contract W-7405-eng-82)
(IS-T-792) Avail: NTIS HC A04/MF A01

A filter fluorometric liquid chromatography detector is constructed using a 1 mm I.D. x 3 mm O.D. quartz capillary tube as the flow cell and a laser as the excitation source. Fluorescence signals are monitored with a photomultiplier tube and photon counting system. The detector is described and characterized for the laser two photon excited fluorometric (LTPEF) detection of the oxadizoles PPD, PBD, and BBD, which are separated on a reverse phase C18 column. Excitation is provided by the absorption of two photons of radiation at 5145 A from an argon ion laser. The detection limits, linearity of response, precision, and selectivity were reported and are found to compare favorably with other UV detection methods. ERA

N78-27390# California Univ., Livermore. Lawrence Livermore Lab. Hazards Control Dept.
GAMMA-RAY DOSIMETRY ERRORS WITH TLDS
C. L. Grahan and S. G. Homann 13 Oct. 1977 15 p refs Presented at the IAEA Symp. on Natl. and Intern. Standardization of Radiation Dosimetry, Atlanta, 5 Dec. 1977
(Contract W-7405-eng-48)
(UCRL-80183; Conf-771209; IAEA-SM-222/15) Avail: NTIS HC A02/MF A01

Gamma-ray dosimetry errors can occur when thermoluminescence dosimeters (TLDs) are irradiated in thin walled containers. An overresponse for LiF TLDs, irradiated by an isotropic source, of approximately 25% for Na24; 20% for Co60, and 2% for Cs137 was observed. The overresponse for CAF2 TLDs was found to be less than the overresponse of LiF TLDs. Underresponse errors can occur for TLDs in thin walled containers irradiated under narrow-beam geometry conditions because electron equilibrium is not established. ERA

N78-27391# California Univ., Berkeley. Lawrence Berkeley Lab.
PICOSECOND RESOLUTION TIME DIGITIZER FOR LASER RANGING
B. Turko 1977 7 p refs Presented at the Nucl. Sci. Symp., San Francisco, 19 Oct. 1977
(Contract W-7405-eng-48)
(LBL-6449; Conf-771023-29) Avail: NTIS HC A02/MF A01

The time digitizer capable of covering a range of 0.34 sec in 9.76 psec increments is described. The time interval between a pair of start stop pulses is digitized coarsely in 20 nsec periods by a very accurate 50 MHz reference clock. The residual fractions of a clock period at the start and the stop end of the measured interval are stretched in two interpolators and digitized in 9.76 psec increments. An equivalent digitizing frequency of 102.4 GHz is thus achieved. The digitizer is built in a CAMAC minicrate and communicates via a standard crate controller. It is intended for use in the laser ranging between ground stations and the Laser Geodetic Satellite (LAGEOS). It was shown that the distribution in any two adjacent 9.76 psec channels of a small number of identical test time intervals is essentially binomial. The performance of the digitizer and test results are given. ERA

N78-27392# California Univ., Berkeley. Lawrence Berkeley Lab.
TIME RESOLUTION PERFORMANCE STUDIES OF CONTEMPORARY HIGH SPEED PHOTOMULTIPLIERS
B. Leskovar and C. C. Lo 1977 10 p refs Presented at the Nucl. Sci. Symp., San Francisco, 19 Oct. 1977
(Contract W-7405-eng-48)
(LBL-6456; Conf-771023-38) Avail: NTIS HC A02/MF A01

The time resolution capabilities of prototype microchannel plate and static crossed field photomultipliers were investigated. Measurements were made of electron transit time, rise time, time response, single photoelectron time spread and multiphotoelectron time spread for LEP HR350 proximity focused high gain curved microchannel plate and VPM-154A/1.6L static crossed field photomultipliers. The experimental data were compared with results obtained with conventionally designed RCS 8850 and C31024 high speed photomultipliers. Descriptions are given of both the measuring techniques and the measuring systems. ERA

N78-27393# Argonne National Lab., Ill.
HIGH-TEMPERATURE SHEAR-MODE TRANSDUCERS FOR LMFBR ULTRASONIC FLOWMETERS
H. B. Karplus Aug. 1977 80 p refs
(Contract W-31-109-eng-38)
(ANL-CT-77-6) Avail: NTIS HC A05/MF A01

The design of an ultrasonic transducer for measuring sodium glow to 500 C in an LMFBR is described. A piezoelectric element backed by a tuned tungsten carbide plate yielded a resonant transducer with a Q of 5. This unit was substituted for the low-temperature plastic wedge transducer supplied with a commercial clamp-on ultrasonic flowmeter. Preliminary measurements in a water loop confirmed operation of the developed high-temperature resonant transducer with commercial flowmeter electronics, requiring only a scale adjustment. Measurements of water flow using the highly damped transducer in conjunction with laboratory pulsers and timers, and special gates and trigger circuits yielded data needed for flowmeter design. ERA

N78-27394# Idaho National Engineering Lab., Idaho Falls.
PRELIMINARY REPORT ON BATTELLE NORTHWEST LIQUID LEVEL PROBES (LLP)
G. R. Coffin and R. E. Ford 11 Nov. 1977 19 p refs
(Contract EY-76-C-07-1570)
(LTR-141-65) Avail: NTIS HC A02/MF A01

The liquid level probe was evaluated for possible use in the LOFT blowdown suppression tank. The results from the test indicate that the probe will measure the liquid level to + or - 1/4 inch, over a range of 50 inches. The next step is to test the functionability of the probe under simulated LOFT-blowdown suppression tank operating conditions. ERA

N78-27395# National Technical Information Service, Springfield, Va.
SCHLIEREN AND SHADOWGRAPH PHOTOGRAPHY. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Mar. 1978

Guy E. Habercom, Jr. May 1978 325 p Supersedes NTIS/PS-77/0346; NTIS/PS-76/0335; NTIS/PS-75/117 (NTIS/PS-78/0411/5; NTIS/PS-77/0346; NTIS/PS-76/0335; NTIS/PS-75/117) Avail: NTIS HC $28.00/MF $28.00 CSCL 14E

A bibliography containing 318 abstracts on the applications and techniques of schlieren and shadowgraph photography is presented. The majority of the information is primarily concerned with flow visualization, although studies on heat transfer and combustion processes are also included. GRA

N78-27396# National Technical Information Service, Springfield, Va.

SCHLIEREN AND SHADOWGRAPH PHOTOGRAPHY. PART 1: FLOW VISUALIZATION AND MEASUREMENT. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Mar. 1978

Guy E. Habercom, Jr. May 1978 211 p Supersedes NTIS/PS-77/0347; NTIS/PS-76/0336 (NTIS/PS-78/0412/3; NTIS/PS-77/0347; NTIS/PS-76/0336) Avail: NTIS HC $28.00/MF $28.00 CSCL 14E

A bibliography containing 204 abstracts concerning worldwide engineering research of Schlieren and shadowgraph photography techniques for flow measurement and visualization is presented. Included are studies on flames, combustion, and aerodynamic configurations. GRA

N78-27397# National Technical Information Service, Springfield, Va.

SCHLIEREN AND SHADOWGRAPH PHOTOGRAPHY. PART 2: GENERAL STUDIES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Mar. 1978

Guy E. Habercom, Jr. May 1978 234 p Supersedes NTIS/PS-77/0348; NTIS/PS-76/0337 (NTIS/PS-78/0413/1; NTIS/PS-77/0348; NTIS/PS-76/0337) Avail: NTIS HC $28.00/MF $28.00 CSCL 14E

A bibliography containing 227 abstracts concerning aspects of schlieren and shadowgraph photography is presented. Techniques, equipment, and applications are reviewed for studying shock waves, combustion, acoustic waves, ballistics, and heat flow. GRA

N78-27398# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

DEVELOPMENT OF AN OPTICAL CONVOLUTION VELOCIMETER FOR MEASURING STACK FLOW Final Report

M. J. Rudd Mar. 1978 37 p refs (Contracts F33615-76-C-3051; EPA-IAG-D6-F044) (PB-279013/7; EPA-600/2-78-049) Avail: NTIS HC A03/MF A01 CSCL 14B

A new type of instrument was developed and tested for the measurement of stack flow velocities. The instrument is optical and generates a shadowgraph pattern of the wake from a small heater. This shadowgraph is projected on a mirror grating of precise dimensions and the reflected light detected by a photodiode. A version of this optical convolution velocimeter was built to withstand a temperature of 200C and combustion gases. This unit was tested in both a wind tunnel and EPA's stationary source simulation facility. The agreement with a pitot tube was close, 1% in the wind tunnel and 2 to 2.5% in the SSSF. GRA

N78-27399# Burroughs Corp., Paoli, Pa. Federal and Special Systems Group.

MAGNETIC TECHNIQUES STUDY Final Report, Jan. - Aug. 1977

Alfred A. Greene, Stephen T. C. Chen, and L. Travis Farris Aug. 1977 196 p refs (Contract DOS-1712-735014) (PB-279086/3; DOS-77/1) Avail: NTIS HC A09/MF A01 CSCL 14B

The capability to encode data magnetically on new passports and this data be frozen, are studied. An exhaustive search was conducted of known expertise in magnetics. A development stage in which magnetic expertise was applied to the development of frozen magnetics, and an evaluation stage in which identified techniques were evaluated both theoretically and empirically are reported. One technique, designated as high coercivity recording with non-magnetic overlay (lamination) emerged as the technique that most nearly met all the requirements and is recommended as the preferred approach for the development of a magnetically encoded machine readable passport. GRA

36 LASERS AND MASERS

Includes parametric amplifiers.

N78-27400 City Univ. of New York.

DYE LASER SYSTEM FOR MONITORING ATMOSPHERIC MOLECULAR POLLUTANTS Ph.D. Thesis

John Steven Gergely 1978 208 p Avail: Univ. Microfilms Order No. 7808676

A laser radar (LIDAR) system was designed, built, and successfully operated to measure ambient NO2 concentrations in the atmosphere. The LIDAR system operated by measuring the differential absorption of scattered energy (DASE) of two laser signals emitted at wavelengths corresponding to a maximum and minimum in the absorption spectrum of NO2. The LIDAR system was designed to be capable of operation in two basic modes. In the first mode, the outputs at the two required wavelengths, on and off resonance absorption of NO2, are obtainable in rapid sequence, with frequency selection by an electromagnetically-driven diffraction grating from a flash-lamp-pumped organic-dye laser. In the second mode, an intracavity dielectric-interface polarizing beam-splitter is used to obtain simultaneously the pair of close lying independently-tunable wavelengths required from the dye laser. Dissert. Abstr.

N78-27401 Wisconsin Univ. - Madison.

CHEMICAL LASER STUDIES OF ELEMENTARY CHEMICAL REACTIONS Ph.D. Thesis

Steven Noel Bittenson 1977 370 p Avail: Univ. Microfilms Order No. 78-04847

A diffraction grating chemical laser technique was used to study vibrational distributions in the diatomic products of the bimolecular processes F + HX yields HF(+) + X(X=C1,Br,I), F + DX yields DF(+) + X(X=C1,Br,I), C1 + HX yields HC1(+) + X (X=Br,I), C1 + DX yields DC1(+) + X(X=Br,I), Br + HI yields HBr(+) + I, Br + DI yields DBr(+) + I, and the unimolecular process H + CF3 yields HF(+) + CF2 and D + CF3 yields DF(+) + CF2, where the superscript dagger labels the vibrational excited lasing product species. Operating characteristics of the lasers and sets of output pulse timing data are provided. The measured HF(DF) vibrational distributions from H + CF3 and D + CF3 resemble statistical distributions: for product HF N sub 0:N sub 1: N sub 2 = 0.53: 0.32:0.15 and for product DF N sub 0:N sub 1:N sub 2:N sub 3 = 0.36:0.29:0.22:0.13. An analytical model of chemical laser pulse timing relationships was developed as an aid in processing experimental timing data and relative gain into vibrational distributions. The experimental chemical laser technique is reviewed, and a descrpition is given of a high gain linear array, multiple flashlamp chemical laser apparatus designed for electronic chemical laser experiments. Dissert. Abstr.

N78-27402* National Aeronautics and Space Administration. Pasadena Office, Calif.

CHARGE TRANSFER REACTION LASER WITH PREIONIZATION MEANS Patent

James B. Lauderslager (JPL) and Thomas J. Pacala, inventors (to NASA) (JPL) Issued 9 May 1978 9 p Filed 12 Jul. 1976 Supersedes N77-19418 (15 - 10, p 1314) Sponsored by NASA (NASA-Case-NPO-13945-1; US-Patent-4,088,965; US-Patent-Appl-SN-704180; US-Patent-Class-331-94.5G; US-Patent-Class-331-94.5PE; US-Patent-Class-331-94.5P) Avail: US Patent Office CSCL 20E

A helium-nitrogen laser is described in which energy in the visible range is emitted as a result of charge transfer reaction between helium ions and nitrogen molecules. The helium and nitrogen are present in a gas mixture at several atmospheres pressure, with a nitrogen partial pressure on the order of a pair of main discharge electrodes, the gas mixture is preionized to

prevent arcing when the discharge pulse is applied. The preionization is achieved by the application of a high voltage across a pair of secondary electrodes which are spaced apart in a direction perpendicular to the spacing direction of the main discharge electrodes and the longitudinal axis of the space in which the gas mixture is contained. Feedback, by means of a pair of appropriately spaced mirrors, is provided, to produce coherent energy pulses at a selected wavelength.
Official Gazette of the U.S. Patent Office

N78-27403*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A FAIL SAFE LASER ACTIVATED SWITCH USED AS AN EMERGENCY CONTROL LINK AT THE LANGLEY VORTEX RESEARCH FACILITY
Philip C. Kassel, Jr. Jun. 1978 15 p ref
(NASA-TM-78752) Avail: NTIS HC A02/MF A01 CSCL 20E

A fail safe light activated switch was used as an emergency control link at the Langley Vortex Research Facility. In this facility aircraft models were towed through a still air test chamber by a gasoline powered vehicle which was launched from one end of a 427-meter track and attained velocities to 31 m/sec in the test chamber. A 5 mW HeNe laser with a mechanical copper provided a connecting link with the moving tow vehicle on which a silicon photodiode receiver with a specially designed amplifier provided a fail safe switching action. This system provided an emergency means of stopping the vehicle by turning off the laser to interrupt the power to the vehicle ignition and brake release systems. Author

N78-27404*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LIFE TEST RESULTS FOR AN ENSEMBLE OF CO2 LASERS
Charles J. Peruso, John J. Degnan, and Urs E. Hochuli (Maryland Univ., College Park) Apr. 1978 31 p refs
(NASA-TM-79536) Avail: NTIS HC A03/MF A01 CSCL 20E

The effects of cathode material, cathode operating temperature, anode configuration, window materials, and hydrogen additives on laser lifetime are determined. Internally oxidized copper and silber-copper alloy cathodes were tested. The cathode operating temperature was raised in some tubes through the use of thermal insulation. Lasers incorporating thermally insulated silver copper oxide cathodes clearly yielded the longest lifetimes-typically in excess of 22,000 hours. The use of platinum sheet versus platinum pin anodes had no observable effect on laser lifetime. Similarly, the choice of germanium, cadmium telluride, or zinc selenide as the optical window material appears to have no impact on lifetime. G.G.

N78-27405*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ENGINEERING A LASER REMOTE SENSOR FOR ATMOSPHERIC PRESSURE AND TEMPERATURE
James Edward Kalshoven, Jr. and Charles Laurence Korb Apr. 1978 19 p
(NASA-TM-79538) Avail: NTIS HC A02/MF A01 CSCL 20E

A system for the remote sensing of atmospheric pressure and temperature is described. Resonant lines in the 7600 Angstrom oxygen A band region are used and an organic dye laser beam is tuned to measure line absorption changes with temperature or pressure. A reference beam outside this band is also transmitted for calibration. Using lidar techniques, profiling of these parameters with altitude can be accomplished. Author

N78-27406# Aerospace Corp., El Segundo, Calif. Aerodynamics Lab.
TWO-KILOHERTZ REPETITION RATE XeF LASER
C. P. Wang and O. L. Gibb 30 Jun. 1978 22 p refs
(ATR-78(9441)-2) Avail: NTIS HC A02/MF A01

High repetition rate laser action, up to 2 kHz, was demonstrated in XeF molecules at 351 and 353 nm by using a blowdown fast transverse flow system and a four circuit, thyratron switched, low inductance pulse generator. For a typical run, the transverse flow was uniform, and the average flow velocity was 25 m/sec across a discharge region of 1.4 x 0.4 x 30 cu cm. The gas mixture used was He:Xe:NF3- 100:1.5:0.5, and the total pressure was varied from 600 to 1200 Torr. For single pulse operation, the maximum laser output energy was 22 mJ/pulse, and the electric efficiency was 0.4%. For a 2 kHz repetition rate, the average laser output energy was approximately 12 mJ/pulse with 50% variations. Hence, an average output power of 24 W was obtained. Author

N78-27407# Army Missile Research and Development Command, Redstone Arsenal, Ala. High Energy Laser and Research Lab.
COMPILATION OF DATA RELEVANT TO RARE GAS-RARE GAS AND RARE GAS-MONOHALIDE EXCIMER LASERS, VOLUME 2
E. W. McDaniel, M. R. Flannery, H. W. Ellis, F. L. Eisele, and W. Pope Dec. 1977 456 p refs
(AD-A053828; DRDMI-H-78-1-Vol-2) Avail: NTIS HC A20/MF A01 CSCL 20/5

Contents: Electron-Heavy Particle Collisions; Photon Collisions with Heavy Particles and Electrons; Transport Properties of Electrons, Ions, and Neutrals in Gases; Interactions with Static or Quasi-Static Electric and Magnetic Fields; Particle Penetration in Gases (Ions, Neutrals and Electrons); and Particle and Photon Interactions with Solids. GRA

N78-27408# Alabama Univ., Huntsville.
LASER INDUCED CHEMISTRY FOR PRODUCTION OF DECABORANE, B10H14, FROM DIBORANE, B2H6 Final Report, 15 Mar. - 15 Jul. 1977
Clyde Riley Oct. 1977 14 p refs
(Contract DAAG29-77-M-0099)
(AD-A053865; ARO-15128.2-C) Avail: NTIS HC A02/MF A01 CSCL 07/2

The goal of this research was to provide information concerning the feasibility of converting B2H6 to B10H14 with CW-CO2 laser irradiation. Author (GRA)

N78-27409# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
INITIAL PHASE IN THE DEVELOPMENT OF AN AUTOMATIC, OPTICAL SCATTER INSPECTION STATION
Edward G. Kessler Dec. 1977 31 p
(AD-A053945; ARLOD-TR-77033) Avail: NTIS HC A03/MF A01 CSCL 20/5

The goal of this program is to develop an automated, optical inspection station useful on a spectrum of munition related components. Laser scatter is composed of speckle whose exact distribution cannot be predicted. However, its envelope can be used to typify the surface profile. Thus, the ability to detect surface features is a function of the ability to resolve this envelope which, in turn is a function of the number of speckle per unit solid angle in the scatter plane. Since the dimensions of speckle are inversely proportional to the illuminating laser beam diameter, there is an implicit lower bound to features detectable by this method. Also, there are lower limits imposed on defect detectability, for actual production items, from background noise arising from surface variations due to the machining process employed. Both speckle and surface variances must be statistically computed on a per component basis in order to establish the usefulness of scatter inspection for that particular component. In order to be applicable to a wide spectrum of situations, a generalized scatter sampling system was constructed. The output is fed into a logic board, providing a degree of pattern recognition capability and yielding a system adaptable to the more difficult discrimination problems. Author (GRA)

N78-27410# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ATMOSPHERIC ATTENUATION OF HeNe LASER RADIATION M.S. Thesis
Graham G. Williford Dec. 1977 77 p refs
(AD-A053442; AFIT/GEP/PH/77-17) Avail: NTIS HC A05/MF A01 CSCL 04/1

Atmospheric attenuation of a low-powered HeNe laser beam was examined both theoretically and experimentally. Experimental results were limited, but useful information could be extracted from the data. Close agreement was found between experimental results and theoretical predictions based on interpolation between aerosol coefficients given by McClatchey and Selby. The effects of atmospheric turbulence upon laser propagation were also

examined. An attempt was made to minimize the effect turbulence had upon test results, so that atmospheric attenuation could be studied independently. The conclusion of a theoretical study was that this could be accomplished by using a receiver several times larger than the beam size at the target. The prediction proved true during test runs. The experimentation was conducted over a 1.23 kilometer course, using a 2 milliwatt HeNe laser as the transmitter, and a 12 inch spherical mirror as the receiver. Tests were conducted under visibility conditions ranging from 2 kilometers to 18 kilometers. Author (GRA)

N78-27411# Naval Research Lab., Washington, D. C.
INTENSE PROTON BEAM PUMPED Ar-N2 LASER Interim Report
J. G. Eden, J. Golden, R. A. Mahaffey, J. A. Pasour, and A. W. Ali Apr. 1978 16 p refs
(AD-A053786; NRL-MR-3761) Avail: NTIS HC A02/MF A01 CSCL 20/5

Gas laser action using a charge and current neutralized photon beam as a pump source is demonstrated. Stimulated emission at 357.7 and 380.5nm was observed in Ar/5% N6 gas mixtures. In comparison with electron beams, protons appear to be more efficient for excitation sources in high pressure UV and visible lasers. GRA

N78-27412# Los Alamos Scientific Lab., N. Mex.
PERFORMANCE CHARACTERISTIC OF DISCHARGE EXCITED EXCIMER LASERS
Robert C. Sze, Peter B. Scott, and T. R. Loree 1977 12 p refs Presented at the 2d Winter Colloq. on Laser Induced Chem., Park City, Utah, 13-16 Feb. 1977
(Contract W-7405-eng-36)
(LA-UR-77-328; Conf-770256-1) Avail: NTIS HC A02/MF A01

The design and operating parameters of a 1/4 J large volume KrF discharge laser are given. Author (ERA)

N78-27413# Oregon Univ., Eugene. Inst. of Theoretical Science.
POSSIBILITY OF COHERENT HARD X-RAY PRODUCTION BY PUMPING WITH SYNCHROTRON RADIATION AND LOW ENERGY PHOTONS
P. L. Csonka 1977 26 p refs Prepared in cooperation with Stanford Univ., Calif.
(Contracts EY-76-S-06-2230-004; E(45-1)-2230; Grant NSF DUR-73-07692)
(RLO/2230/T5-192) Avail: NTIS HC A03/MF A01

Coherent X-rays in the keV range could be produced by pumping a suitable gas with synchrotron radiation in combination with low energy photon beams in the presence of appropriately arranged mirrors. With a wiggler magnet placed in the low beta section of the PEP machine, 1020 eV coherent photons could be produced from Ne. Appropriate synchrotron radiation will produce a highly ionized cool gas. Low energy photons modify the outer electron structure of ions to enhance lasing. They modify the lifetime of the inverted state, counterbalance unwanted collisionally induced transitions, and reduce Stark line broadening. ERA

N78-27414# Los Alamos Scientific Lab., N. Mex.
THEORETICAL ASSESSMENT OF RADIATION DAMAGE EFFECTS IN A PROPOSED GAMMA-RAY LASER SYSTEM
Harold R. Schwenn Jan. 1978 98 p refs
(Contract W-7405-eng-36)
(LA-7099-T) Avail: NTIS HC A05/MF A01

The question of the feasibility of pumping a gamma-ray laser (graser) with a nuclear explosion; in particular, to the problem of estimating the reduction of the cross section for stimulated emission, caused by radiation damage associated with neutron pumping, as far as this can be determined from present understanding of the effects of radiation damage on the Moessbauer effect is addressed. G.Y.

N78-27415# California Univ., Livermore. Lawrence Livermore Lab.
CONCERNING THE GENERATION OF VERY HIGH PRESSURES FOR EOS STUDIES WITH ULTRA-HIGH POWER LASER PULSES
L. L. Wood, R. N. Keeler, and J. H. Nuckolls Jul. 1977 15 p Presented at 6th AIRAPT Intern. High-Pressure Conf., Boulder, Colo., 25 Jul. 1977
(Contract W-7405-eng-48)
(UCRL-79610-Rev-1; Conf-770706-31) Avail: NTIS HC A02/MF A01

The use of basic physical and geometric principles, coupled with current laser technology, seems likely to extend experimental hyperbaric physics investigations from the megabar region into the portions of parameter space in which the ideal (degenerate) Fermi gas approximation is valid for even the highest Z materials. Implosions and speed multiplying rectilinear stacks of flat plates seem particularly apt techniques for the near term, transient attainment of pressure of 10 to the 9th power atmospheres in the laboratory, and laser energized pulsed X-ray cameras appear suitable for analyzing the basic properties of matter under such conditions. ERA

N78-27416# California Univ., San Diego, La Jolla. Inst. of Pure and Applied Physical Sciences.
THEORETICAL AND EXPERIMENTAL STUDY OF FAST-DISCHARGE-DRIVEN RARE GAS MONOHALIDE LASERS Final Technical Report
T. K. Tio, R. P. Akins, G. Innis, and S. C. Lin 31 Dec. 1977 76 p refs
(Contract W-7405-eng-48)
(UCRL-13816) Avail: NTIS HC A05/MF A01

The coupling between the fast discharge and the kinetic processes of excimer laser generation was studied to obtain useful scaling relationships for future development of more efficient and/or higher average power pulsed-discharge pumped rare gas monohalide laser systems. Special attention was given to the generation of ultraviolet laser lines in the 351 to 354 nm region from the XeF excimer and also the ultraviolet lines near 308 nm from the SeCl excimer. ERA

N78-27417# California Univ., Berkeley. Lawrence Berkeley Lab.
DESIGN AND PERFORMANCE CHARACTERISTICS OF A SENSITIVE CARBON MONOXIDE OPTOACOUSTIC DETECTOR
R. Gerlach and N. M. Amer 1978 26 p refs Presented at the Am. Phys. Soc. Meeting, Washington, D.C., 27-30 Mar. 1978
(Contract W-7405-eng-48)
(LBL-6818; Conf-780313-1) Avail: NTIS HC A03/MF A01

Laser optoacoustic detection of carbon monoxide with a sensitivity of 0.15 parts per million was achieved. A carbon monoxide laser oscillating on transitions in the fundamental band, intensity modulated by means of an electro-optic modulator, was used. The performance of acoustically resonant and nonresonant optoacoustic cells was compared, and it was found that the minimum detectable concentration was lower for the resonant cell, but that the nonresonant cell was suitable for operation at pressures below atmospheric pressure. The pressure dependence of the optoacoustic signal is discussed in the context of atmospheric absorption. ERA

N78-27418# California Univ., Livermore. Lawrence Livermore Lab.
LASER-GENERATED SHOCK-WAVE EXPERIMENTS IN METAL ABOVE 1 TPa
R. J. Trainor, J. W. Shaner, J. M. Auerbach, and D. W. Phillion 31 Jan. 1978 13 p Presented a APS Soc. Meeting, San Francisco, 22 Jan. 1978
(Contract W-7405-eng-48)
(UCRL-80257) Avail: NTIS HC A02/MF A01

Some initial experiments are described which form part of a new program aimed at significantly extending the range of high pressures and densities which may be exposed in laboratory equation-of-state (EOS) experiments. These experiments will utilize high-energy lasers to generate intense shock waves in materials of interest. ERA

N78-27419# California Univ., Livermore. Lawrence Livermore Lab.
THEORY FOR LASER-INDUCED BREAKDOWN OVER VAPORIZING TARGET SURFACE

R. J. Harrach Dec. 1977 27 p refs
(Contract W-7405-eng-48)
(UCRL-52389) Avail: NTIS HC A03/MF A01

A simple but accurate theoretical model is developed to describe the growth of avalanche ionization (breakdown) in the blowoff vapor from a laser-irradiated surface. The model pertains only to the early stages of laser-target interaction, from the time surface vaporization begins to when first-degree ionization is achieved in the vapor. Approximate analytical solutions are found for the basic differential equations of the model, and such key quantities as breakdown time and threshold values of laser fluence and intensity are expressed in terms of simple formulas. With the model, general trends and specific parametric dependences are predicted. The analytical solutions are shown to agree well with accurate numerical solutions of the equations and with documented data on CO2 laser-induced breakdown over aluminum targets. ERA

N78-27420# California Univ., Livermore. Lawrence Livermore Lab.
TIME-DEPENDENT PROPAGATION OF HIGH-ENERGY LASER BEAMS THROUGH THE ATMOSPHERE, 3
J. R. Morris and J. A. Eleck 14 Dec. 1977 42 p refs
(Contract W-7405-eng-48)
(UCRL-52377) Avail: NTIS HC A03/MF A01

An accurate computational model of combined strong t3-blooming and steady-state multiple-pulse blooming is described. A single-pulse calculation and a series of calculations for an overlap number of 1.5 are presented. A new method is derived for calculating a corrective phase to compensate for thermal blooming. This method, which is based on an equivalent thin-lens model, provides a fast and accurate estimate of the compensating phase when most of the phase distortion occurs near the laser. It is capable of computing the steady-state compensation for thermal blooming of either CW or multiple-pulse laser beams in noncoplanar scenarios. Several examples of phase compensation calculations are presented including compensation for a quasi-stagnation zone (an almost zero wind-speed minimum) near the laser. Finally, the effects of realistic intensity and phase profiles, stagnation zones, and smoke clouds on laser beam propagation in Army scenarios are examined. ERA

N78-27421# Energy Research and Development Administration, Washington, D. C. Div. of Magnetohydrodynamics.
CO2 MAGNETOHYDRODYNAMIC LASER
L. M. Biberman, V. S. Vorobyov, and R. S. Ivanov 1977 69 p refs Presented at US-USSR Steering Committee for Coop. in MHD; Washington, D.C., 13 Apr. 1977
(CONF-770402-1) Avail: NTIS HC A04/MF A01

The magnetohydrodynamic laser is theoretically examined. Calculations of optimum lasing medium compositions, examination of various flow modes, calculation of amplification coefficient, and of magnetohydrodynamic laser emission intensity are among the topics included. Results of the experimental studies of the magnetohydrodynamic laser are discussed. ERA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N78-27422 Houston Univ., Tex.
AN EXTENSION OF SHAW'S THEORY TO CONICAL TERMINATIONS: A NEW TECHNIQUE FOR MUFFLER DESIGN Ph.D. Thesis
Bhalchandra Narahari Nagarkar 1978 146 p
Avail: Univ. Microfilms Order No. 78-08100

Shaw's theory of sound propagation in acoustic horns with spatially varying density and elasticity is extended to conical terminations. The density variation technique was applied to simulate a conical termination in a tube of uniform cross section using perforated sheet-metal plates. The performance of the density variation horn and the equivalent conical horn was evaluated by comparison of the acoustic impedance and the acoustic pressure within the horns. It was observed that the density-variation conical horn had sound absorbing properties as a result of the use of the perforated plates to simulate density variation. A prototype muffler was desinged such that it would be suitable as an automobile muffler. The performance was evaluated using both a loudspeaker and an internal combustion engine as sound sources. Dissert. Abstr.

N78-27423* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
VARIABLE CONTOUR SECURING SYSTEM Patent
Paul P. Zebus (Rockwell International, Downey, Calif.), Poley N. Packer (Rockwell International, Downey, Calif.), and Cyrus C. Haynie, inventors (to NASA) (Rockwell International, Downey, Calif.) Issued 9 May 1978 8 p Filed 27 Sep. 1977 Supersedes N78-10434 (16-1, p 0064) Sponsored by NASA
(NASA-Case-MSC-16270-1; US-Patent-4,088,312;
US-Patent-Appl-SN-837260; US-Patent-Class-269-21;
US-Patent-Class-269-266) Avail: US Patent Office CSCL 13I

A variable contour securing system has a retaining structure for a member whose surface contains a variable contour. The retaining mechanism includes a spaced array of adjustable spindles mounted on a housing. Each spindle has a base member support cup at one end. A vacuum source is applied to the cups for seating the member adjacent to the cups. A locking mechanism sets the spindles in a predetermined position once the member has been secured to the spindle support cups.
Official Gazette of the U.S. Patent Office

N78-27424* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MAGNETIC SUSPENSION AND POINTING SYSTEM Patent
Willard W. Anderson and Nelson J. Groom, inventors (to NASA) Issued 9 May 1978 5 p Filed 17 Jun. 1977 Supersedes N78-10433 (16 - 1, p 0064) Division of US Patent Appl. SN-662182, filed 27 Feb. 1976
(NASA-Case-LAR-11889-2; US-Patent-4,088,018;
US-Patent-Appl-SN-807703; US-Patent-Class-73-178R;
US-Patent-Class-308-10; US-Patent-Appl-SN-662182) Avail: US Patent Office CSCL 13I

An apparatus is reported for accurate pointing of instruments on a carrier vehicle and for isolation of the instruments from the vehicle's motion disturbances. The apparatus includes two assemblies with connecting interfaces. The first assembly is attached to the carrier vehicle and consists of an azimuth gimbal and an elevation gimbal which provide coarse pointing by allowing two rotations of the instruments relative to the carrier vehicle. The second or vernier pointing assembly is made up of magnetic suspension and fine pointing actuators, roll motor segments, and an instrument mounting plase which provides appropriate magnetic circuits for the actuators and the roll motor segments. The vernier pointing assembly provides attitude fine pointing and roll positioning of the instruments as well as six degree-of-freedom isolation from carrier motion disturbances.
Official Gazette of the U.S. Patent Office

N78-27425* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ROTARY LEVELING BASE PLATFORM Patent
Robert W. Delaplaine and Daniel L. Mossolani, inventors (to NASA) Issued 9 May 1978 5 p Filed 2 Nov. 1976 Supersedes N77-10498 (15 - 01, p 0069)
(NASA-Case-ARC-10981-1; US-Patent-4,088,291;
US-Patent-Appl-SN-738218; US-Patent-Class-248-186;
US-Patent-Class-248-178) Avail: US Patent Office CSCL 13I

A leveling apparatus for the precise adjustment of a scientific instrument is reported. A base member is provided having a hollow cylindrical shape. A table for supporting the instrument rests on the base and has a shaft portion extending below the table. The upper portion of the shaft fits tightly into the hollow portion of the base member whereas the lower portion of the shaft is machined to fit loosely. The lower portion of the shaft is provided with a groove. Adjusting screws are threaded through the hollow cylindrical portion and are adapted to enter the groove. By adjusting the screws, the lower portion of the shaft is moved in a vertical plane since the shaft is loosely fitted into the cylinder. The upper portion of the shaft which is tightly fitted into the upper end of the cylinder causes the cylinder to deform slightly providing a fulcrum point which allows the

table to be leveled in response to the adjustment of the adjusting screws. Official Gazette of the U.S. Patent Office

N78-27426 Carnegie-Mellon Univ., Pittsburgh, Pa.
DYNAMIC MODELING AND CONTROL OF INJECTION MOLDING MACHINES Ph.D. Thesis
Ajay Shankar 1978 231 p
Avail: Univ. Microfilms Order No. 7807190

The development of a deterministic nonlinear lumped parameter mathematical model useful for the study and design of polymer injection molding machines and their associated controllers is presented. The mathematical model was simulated on a digital computer using real machine parameters and the results compared with experimental measurements taken on an injection molding machine. A comparison of these results showed that the developed mathematical model adequately predicts the transient behavior of averaged machine and mold variables. The resulting model is useful for control system design and machine parameter slection. An improved method of estimating melt flow rate was developed and a new control technique based on discrete iterative control was developed and evaluated. Dissert. Abstr.

N78-27427*# Detroit Diesel Allison, Indianapolis, Ind.
AERODYNAMIC PERFORMANCE OF CONVENTIONAL AND ADVANCED DESIGN LABYRINTH SEALS WITH SOLID-SMOOTH ABRADABLE, AND HONEYCOMB LANDS Final Report, 21 Jul. 1976 - 21 Nov. 1977
H. L. Stocker, D. M. Cox, and G. F. Holle Nov. 1977 272 p refs
(Contract NAS3-20056)
(NASA-CR-135307; EDR-9339) Avail: NTIS HC A12/MF A01 CSCL 11A

Labyrinth air seal static and dynamic performance was evaluated using solid, abradable, and honeycomb lands with standard and advanced seal designs. The effects on leakage of land surface roughness, abradable land porosity, rub grooves in abradable lands, and honeycomb land cell size and depth were studied using a standard labyrinth seal. The effects of rotation on the optimum seal knife pitch were also investigated. Selected geometric and aerodynamic parameters for an advanced seal design were evaluated to derive an optimized performance configuration. The rotational energy requirements were also measured to determine the inherent friction and pumping energy absorbed by the various seal knife and land configurations tested in order to properly assess the net seal system performance level. Results indicate that: (1) seal leakage can be significantly affected with honeycomb or abradable lands; (2) rotational energy absorption does not vary significantly with the use of a solid-smooth, an abradable, or a honeycomb land; and (3) optimization of an advanced lab seal design produced a configuration that had leakage 25% below a conventional stepped seal. A.R.H.

N78-27428*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELASTOHYDRODYNAMIC FILM THICKNESS MEASUREMENTS OF ARTIFICIALLY PRODUCED SURFACE DENTS AND GROOVES
L. D. Wedeven and C. Cusano (Illinois Univ., Urbana) 1978 38 p refs Proposed for presentation at the Joint Lubrication Conf., Minneapolis, Minn., 24-26 Oct. 1978; Sponsored by ASME and Am. Soc. of Lubrication Engineers
(NASA-TM-78949; E-9693) Avail: NTIS HC A03/MF A01 CSCL 13I

Elastohydrodynamic (EHD) film thickness measurements using optical interferometry were made of artificially produced dents and grooves under rolling and sliding conditions. These measurements are compared to stylus traces of the dent and groove profiles to determine the local deformation associated with micro-EHD pressure generation. The surface geometry associated with the dents and grooves became intimately involved in the lubrication process itself, creating local pressure variations that substantially deformed the local surface geometry, particularly under sliding conditions. The rolling results implied surface initiated fatigue, and the sliding results showed clearly the EHD surface interactions that must occur prior to scuffing failure. J.A.M.

N78-27429*# SKF Industries, Inc., King of Prussia, Pa. Research Lab.
EMERGENCY AND MICROFOG LUBRICATION AND COOLING OF BEARINGS FOR ARMY HELICOPTERS Final Report, Dec. 1972 - Jun. 1977
J. W. Rosenlieb Jan. 1978 125 p refs
(Contract NAS3-17343)
(NASA-CR-135195; SKF-AL77T021) Avail: NTIS HC A06/MF A01 CSCL 13I

An analysis and system study was performed to provide design information regarding lubricant and coolant flow rates and flow paths for effective utilization of the lubricant and coolant in a once-through oil-mist (microfog) and coolant air system. A system was designed, manufactured, coupled with an existing rig and evaluation tests were performed using 46 mm bore split-inner angular-contact ball bearings under 1779N (400 lb.) thrust load. An emergency lubrication aspirator system was also manufactured and tested under lost lubricant conditions. The testing demonstrated the feasibility of using a mist oil and cooling air system to lubricate and cool a high speed helicopter engine mainshaft bearing. The testing also demonstrated the feasibility of using an emergency aspirator lubrication system as a viable survivability concept for helicopter mainshaft engine bearing for periods as long as 30 minutes. Author

N78-27430*# National Aeronautics and Space Administration, Washington, D. C.
THE EFFECT OF LOAD IN A CONTACT WITH BOUNDARY LUBRICATION
J. M. Georges, B. Lamy, M. Daronnat, and S. Moro Jun. 1978 91 p refs Transl. into ENGLISH of "Influence de la Charge dans un Contact sous Lubrification Limite" Ecole Centrale de Lyon Lab. de Technol. des Surfaces, Apr. 1975 80 p Original language document was announced as N77-13423 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-2790)
(NASA-TM-75289) Avail: NTIS HC A05/MF A01 CSCL 20K

The effect of the transition load on the wear in a contact with boundary lubrication was investigated. An experimental method was developed for this purpose, and parameters affecting the boundary lubrication under industrial operating conditions were identified. These parameters are the adsorbed boundary film, the contact microgeometry (surface roughness), macrogeometry, and hardness of materials used. It was found that the curve of the tops of the surface protrustion affect the transition load, and thus the boundary lubrication. The transition load also depends on the chemical nature of the contact and its geometrical and mechanical aspects. Author

N78-27431# Royal Aircraft Establishment, Farnborough (England).
LOAD DISTRIBUTION BETWEEN HARMONIC DRIVE TEETH
Yu. P. Fuks and V. A. Finogenov Aug. 1977 14 p refs Transl. into ENGLISH from Isv. Vyssh. Uchebn. Zaved. Machinostr. (USSR), v. 12, 1971 p 23-28
(RAE-Lib-Trans-1929; BR6919) Avail: NTIS HC A02/MF A01

A harmonic tooth gear consisting of an immobile rigid gear, a rotating flexible gear and a cam generator are examined. A method is given for determining the load acting on the teeth of this harmonic gear. G.Y.

N78-27432# Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio.
EVALUATION OF F-16 RADAR ATTACHMENT ASSEMBLIES FOR REUSABLE CONTAINERS Interim Report
James D. Heck Mar. 1978 10 p refs
(AD-A053424; PTPT-78-8) Avail: NTIS HC A02/MF A01 CSCL 13/5

The objective of this evaluation was to determine if mounting brackets for antenna and the transmitter would maintain mounting integrity through transportation, rough handling and environmental testing. The results of this study indicated that the mounting brackets for the antenna and the transmitter will maintain integrity during shipment and handling. Author (GRA)

N78-27433# Rocket Research Corp., Redmond, Wash.
HYDRAZINE APU STARTER DESIGN Final Report, Nov. 1976 - Nov. 1977
L. D. Galbraith Dec. 1977 167 p
(Contract F3315-76-C-2148)
(AD-A053764; AFAPL-TR-77-76) Avail: NTIS HC A08/MF A01 CSCL 21/5

The purpose of this program was to design a hot gas motor that would subsequently be used as the prime mover in an advanced aircraft auxiliary power unit starter system. The report describes the APU starter system approach and the design details of the hot gas motor. The hot gas motor is a rotary vane device that would be powered with the decomposition products of a hydrazine-based fuel blend. Two computer models are presented for predicting the thermal-structural and thermal-performance characteristics of the hot gas motor over the required ambient temperature range of -65 to +130 F. Author (GRA)

N78-27434# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
EVALUATION OF SOLID LUBRICATED BEARINGS UTILIZING CARBONIZED PHENOLIC COMPOSITE CAGES Interim Report, Aug. 1976 - Jan. 1977
John B. Schrand, Ronald D. Dayton, and Mac A. Sheets Jan. 1978 44 p refs
(AD-A053760; * AFAPL-TR-78-3) Avail: NTIS HC A03/MF A01 CSCL 13/9

Solid lubricated bearings utilizing a carbonized phenolic resin composite cage have been evaluated. Functional tests using 204 size bearings were run under ambient conditions at speeds up to 10,000 rpm. The average life of the five bearings tested was 18 1/4 hours with the maximum life being less than 50 hours. No further testing of these particular materials is anticipated. Author (GRA)

N78-27435# Department of Energy, Washington, D. C.
DESIGN AND CONSTRUCTION OF HELIUM TURBINES, HELIUM COMPRESSORS, AND HELIUM TURBINE POWER PLANTS
Karl Bammert 1977 28 p refs Transl. into ENGLISH of unidentified Russian report Presented at the Symp. on Turbogenerators, Moscow, 9 Jun. 1977; sponsored by the Min. for Chem. and Petrol. Machine Construct.
(DOE-tr-33) Avail: NTIS HC A03/MF A01

The design, construction, and operational behavior of a 50 MW helium turbine plant is discussed with details on thermodynamic considerations, detailed design of power plant components including helium compressors, turbogenerators, heat exchangers, helium seals, pipelines, and control systems, and the design of a turboset for a 1000 MW plant. It is concluded that the design of helium turbines is not in principle different from that of hot air turbines so that the experience acquired with air installations can be fully utilized, and that using the example of the helium turbine plant, the helium-specific problems can be solved. Further, it was described how the turboset can be practically designed for 1000 MW plants. This design also shows that the helium-specific problems are capable of being mastered and the helium turbine is best suited for high capacity power plants which are accommodating to the environment and conserve energy. Author (ERA)

N78-27436# Union Carbide Corp., Oak Ridge, Tenn.
HEATING5 ANALYSIS OF A WELDING PROBLEM
G. E. Giles, D. C. Elrod, and I. I. Siman-Tov 1977 26 p Presented at Symp. and Workshop on Moving Boundary Problems, Gatlinburg, Tenn., 26 Sep. 1977
(Contract W-7405-eng-26)
(K/CSD/INF-77/17; Conf-770965-1) Avail: NTIS HC A03/MF A01

The geometry and thermal properties of a circumferential weld are modeled. The three parameters that were determined empirically were: (1) the time and spatial variation in heat generation; (2) the conductivity of the molten material; and (3) the anisotropic conductivity (simulating gap resistance). The heat generation alone appeared to control the temperature field outside of an approximate circle of radius r sub 1 around the weld. Radius r sub 1 is less than the distance from the weld to the closest thermocouple. The area of concern in the thermal stress analysis lies outside r sub 1. Within this circle the molten conductivity and the anisotropic conductivity of the solid also became major influences on the temperature field. By matching the thermocouple temperature and the melt zone, the temperature field is accurately represented by the computed results. Author (ERA)

N78-27437# General Atomic Co., San Diego, Calif.
BEARING COMPARTMENT SEAL SYSTEMS FOR TURBOMACHINERY IN DIRECT-CYCLE HTGR POWER PLANTS
R. G. Adams, F. H. Boeing, and G. D. Pfeifer Oct. 1977 48 p refs Presented at 23d Intern. Gas Turbine Conf., London, 9 Apr. 1978
(Contract EY-76-C-0167-046)
(GA-A-14410; Conf-780405-1) Avail: NTIS HC A03/MF A01

The direct cycle High Temperature Gas Cooled Reactor employs a closed gas turbine cycle with the primary reactor coolant (helium) as the working fluid. Design studies on this type of plant demonstrate the advantages of the integrated arrangement, in which power from the cycle is transmitted to the electric generator by turbomachines completely enclosed in the reactor pressure vessel. An important aspect of the design of the turbomachinery is its prevention or minimization of the ingress of primary coolant into the bearing compartments. The design studies showed that total exclusion of lubricant requires extremely complex seals and seal support systems. The variation of system low end with control actuation and the requirement that the bearing cavity pressure follow these variations were proved to further complicate the service system. The tolerance of even relatively minute amounts of entering lubricants will allow considerable simplification. This paper discussed the problems and their solutions in tracing the design evolution of a satisfactory bearing compartment seals and service system. ERA

N78-27438# California Univ., Livermore. Lawrence Livermore Lab.
DETERMINATION OF THE EFFECTIVENESS AND FEASIBILITY OF REGENERATIVE BRAKING SYSTEMS ON ELECTRIC AND OTHER AUTOMOBILES. VOLUME 2: DESIGN STUDY AND ANALYSIS Final Report
D. D. Davis, R. A. Renner, F. C. Younger, R. C. Epps, and S. S. Lerner 25 Oct. 1977 289 p refs
(Contract W-7405-eng-48)
(UCRL-52306-Vol-2) Avail: NTIS HC A03/MF A01

Details of the analyses performed are presented plus appendices in which study team members and organizations contacted are listed and supporting data are compiled. The topics discussed are (1) definitions and principles; (2) the history of regenerative braking; (3) case studies (existing vehicles and concepts); (4) the Lawrence Livermore Laboratory design study and analysis; (5) energy impact and cost effectiveness; and (6) a patent review. ERA

N78-27439# Princeton Univ., N. J. Dept. of Aerospace and Mechanical Sciences.
NUMERICAL COMPUTATIONS OF TWO-DIMENSIONAL, UNSTEADY SPRAYS FOR APPLICATION TO INTERNAL COMBUSTION ENGINES
F. V. Bracco, H. C. Gupta, and C. K. Westbrook (LLL, Livermore, Calif.) Jan. 1978 37 p refs
(Contract W-7405-eng-48)
(UCID-17700) Avail: NTIS HC A03/MF A01

The problem was considered of an unsteady, two dimensional spray, vaporizing and penetrating air in the combustion chamber of a direct injection compression ignition, or stratified charge engine. The motivation was provided by the sensitivity of engine efficiency and emissions to the local combustion chamber process. The spray equation, which was the governing equation and in this application exhibited six independent variables, was numerically solved using an upwind difference scheme which was first order accurate and explicit in time. Emphasis was placed on the method of solution and its accuracy. The problem was set up both as a boundary value problem and as an equivalent initial value problem. The boundary value formulation was preferable for applications. The numerical error of the initial value problem was studied, by comparing the numerical solution with an analytical one. ERA

N78-27440# Department of Energy, Washington, D. C.
HELIUM HEATERS OF THE HELIUM TURBINE UNIT OF THE OBERHAUSEN ENERGY SUPPLY
G. Innocente, H. Wydler, and J. Halzl Jun. 1977 11 p Transl. into ENGLISH from VGB Kraftwerkstech. (Germany), no. 6, Jun. 1977 p 375-380
(DOE-tr-35) Avail: NTIS HC A02/MF A01

The high working medium temperature and the low pressure loss on the medium side with helium turbine units indicate limiting values with respect to the materials as well as to the manufacture of thick walled collectors. Various aspects of design, manufacture, and assembly were studied. A 50 MW gas turbine supplied by conventionally heated helium is part of the nuclear energy program of the Federal Republic of Germany for development of the high temperature reactor with high capacity helium turbines. A turbine such as this was constructed for the energy supply at Oberhausen. The plant will not only generate current and heat but also offer the opportunity for testing out essential components of the closed circuit as they are installed in a nuclear heated power plant. ERA

N78-27441# AiResearch Mfg. Co., Phoenix, Ariz.
CLOSED GAS TURBINE HEATER PROGRAM Quarterly Technical Progress Report, 4 Jul - 2 Oct. 1977
R. Stefun and D. Softley 12 Dec. 1977 41 p refs
(Contract EF-77-C-01-2611)
(TID-28200; QTPR-2) Avail: NTIS HC A03/MF A01

The objective of this program is to advance high-temperature closed gas turbine power conversion systems to a point of technological readiness for use in coal fired public utility power conversion plants. The initial contract addresses two specific problem areas. These are: (1) the identification and analysis of system concepts which offer highest overall plant efficiency consistent with lowest cost of electricity (COE) from coal-pile-to-bus-bar; and (2) the identification and preliminary design of combustor/heat exchanger concepts compatible for use as the cycle gas primary heater for those plant systems. System cycle analyses and parametric studies performed to evaluate entire closed gas turbine utility power plants, with and without Rankine bottoming cycles with emphasis on lowest COE. Two heater systems based on 1550F are closed gas turbine inlet temperature using metallic materials and two based on 1750F and higher using non-mettalic materials. ERA

N78-27442# Battelle Columbus Labs., Ohio.
RESIDUAL STRESSES AT WELD REPAIRS IN PRESSURE VESSELS Quarterly Progress Report, 1 Sep. - 1 Dec. 1977
E. F. Rybicki and R. B. Stonesifer Apr. 1978 34 p refs
(Contract AT(49-24)-0293)
(PB-279581/3; NUREG-CR-0037; QPR-1) Avail: NTIS HC A03/MF A01 CSCL 18I

Efforts focused on developing the temperature analysis model and the stress analysis model for the weld repair conditions of the HSST ITV-8 vessel. Based on selected test cases, computations were performed to study temperature profiles and the effect of the vessels inner surface on the temperatures. These studies showed that the simple heat flow model is an appropriate choice for the weld repair conditions. Changes were made in the computational stress analysis model to represent (1) the 3 dimensional geometry, (2) plane strain effects, and (3) residual stresses due to the half bead weld technique. GRA

N78-28037# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF INERTIAL FORCES OF LUBRICANT FLOW ON THE STABILITY OF A SHAFT ROTATING ON RESILENT GAS DYNAMICAL PLAIN BEARINGS
A. S. Kelzon and V. I. Yakovlev *In its* Transl. on USSR Sci. and Technol. (JPRS-71393) 30 Jun. 1978 p 26-33 refs Transl. into ENGLISH from Mashinovedeniye (Moscow), no. 6, Nov. - Dec. 1977 p 19-23 (For primary document see N78-28033 18-99)
Copyright. Avail: NTIS HC A05/MF A01

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N78-27443*# National Aeronautics and Space Administration, Washington, D. C.
ACOUSTIC EMISSION ANALYSIS: A TEST METHOD FOR METAL JOINTS BONDED BY ADHESIVES
Walter Brockmann and Tilman Fischer Jul. 1978 24 p refs Transl. into ENGLISH from Materialpruefung (Dusseldorf), v. 19, Oct. 1977 p 430-436 Original language document was announced as A78-11971
(NASA-TM-75315) Avail: NTIS *HC A02/MF A01 CSCL 14D

Acoustic emission analysis is applied to study adhesive joints which had been subjected to mechanical and climatic stresses, taking into account conditions which make results applicable to adhesive joints used in aerospace technology. Specimens consisting of the alloy AlMgSi0.5 were used together with a phenolic resin adhesive, an epoxy resin modified with a polyamide, and an epoxy resin modified with a nitrile. Results show that the acoustic emission analysis provides valuable information concerning the behavior of adhesive joints under load and climatic stresses. G.G.

N78-27444# Naval Postgraduate School, Monterey, Calif.
HOLOGRAPHIC NONDESTRUCTIVE TESTING OF PIPES M.S. Thesis
Paul Mikel Huber Mar. 1978 63 p refs
(AD-A053776) Avail: NTIS HC A04/MF A01 CSCL 13/11

Pipes with internal and external radial and axial flaws were tested using double-exposure interferometric holography. A hydrostatic pressure was applied internally between exposures to stress each specimen. Photographs of the resulting holograms are presented. Surface displacements were measured from the interference fringe patterns formed in the holograms. Finite element methods were used to compute expected displacements. The results of the two methods compared within 32%. Additional specimens with internal grooves, which simulate warheads, were tested to determine if fragmentation patterns could be predicted by nondestructive means using holographic techniques. The method of holographic interferometry shows great promise for immediate application for warhead development. Author (GRA)

N78-27445# Drexel Univ., Philadelphia, Pa. Dept. of Mechanical Engineering and Mechanics.
ULTRASONIC PROCEDURES FOR THE DETERMINATION OF BOND STRENGTH Final Report, 1 Jan. 1973 - 1 Jan. 1978
Joseph L. Rose and Graham H. Thomas 1978 44 p refs
(Grant AF-AFOSR-2480-73; AF Proj. 2307)
(AD-A053771; AFOSR-78-0843TR) Avail: NTIS HC A03/MF A01 CSCL 13/8

An ultrasonic inspection system for the prediction of adhesive bond strength for metal-to-metal applications is of great value to the U.S. Air Force, as well as many other agencies. The prediction of adhesive bond strength, assuming there are no delaminations, inclusions, or such cohesive type problem as curing, etc. is the goal of this study. Ultrasonically evaluating adhesive bonds that have partially delaminated, is easily accomplished using C-scan techniques, but a major problem arises when the defect in the bond is either adhesive or cohesive in nature. This study involved primarily the adhesive aspect of the bond strength, which is related to the surface preparation problem. Test specimens were manufactured so that a deficient surface preparation occurred on either or both substrates in an aluminum-to-aluminum step-lap joint. The specimens with little or no surface preparation provided weak bonds, and the specimens with proper surface preparation, in general, produced strong bonds. GRA

N78-27446# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
RELIABILITY: AVIATION MATERIEL
Roy L. Miller 28 Jul. 1977 14 p
(AD-A053400; TOP-7-3-508) Avail: NTIS HC A02/MF A01 CSCL 15/5

This document identifies testing methods and techniques necessary to determine the degree to which Army aviation materiel meets the 'Reliability' set for in the requirements documents.
Author (GRA)

N78-27447# Avco-Everett Research Lab., Everett, Mass.
DEVELOPMENT PROGRAM FOR MHD POWER GENERATION. VOLUME 4: SUPERCONDUCTING MAGNET STUDY Final Report, 1 Jul. 1975 - 30 Jun. 1976
A. M. Hatch, R. C. Beals, and A. J. Sofia Apr. 1977 163 p (Contract EX-76-C-01-2015)
(FE-2015-16-Vol-4) Avail: NTIS HC A08/MF A01

Methods for making and nondestructively inspecting joints in superconductors of the type applicable to MHD magnets were investigated. Soldering fixtures were made, soldering procedures developed and X-ray and ultra-sonic inspection techniques tried out. A number of sample joints of various designs, including joints bonded with alternate soft-solders and also by cold-welding, were prepared for final testing and evaluation. A special test apparatus was designed and built, suitable for testing joints in liquid helium at currents comparable to those used in MHD magnet windings and with various tension loads up to breaking loads. Joint surface resistivities were determined, sample elongations vs. load were measured and breaking strengths were determined. One sample was subjected to a stress cycling test. The performance of various types of joints was compared and the effects of variations in design and fabrication were evaluated. ERA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N78-27448 Wisconsin Univ., Madison.
ELASTIC LATERAL BUCKLING OF ORTHOTROPIC BEAMS Ph.D. Thesis
Anand Rangarajan 1978 199 p
Avail: Univ. Microfilms Order No. 7804876

The elastic lateral buckling strength of orthotropic beams of narrow rectangular cross sections and I-sections was determined using a generalized moment curvature relationship to formulate the governing differential equations. The behavior of orthotropic I-beams subjected to torsional loads was also investigated to obtain the angles of twist and the induced stresses. As an area of secondary interest, the generalized moment curvature relationship was used to derive the member stiffness matrix, fixed end moments and moment area theorems for composite members in bending. The generalized moment curvature relationship used to derive the governing differential equations takes into its consideration the effect of higher order internal moment gradients on the curvature of the elastic curve. The strength of materials solutions accurately predicts the buckling strength of beams made of E-glass polyester composites. Modification factors for stresses and angles of twist for torsion of orthotropic I-beams are also presented. Dissert. Abstr.

N78-27449 West Virginia Univ., Morgantown.
ANALYSIS OF PLATES WITH VARIOUS SHAPES AND BOUNDARIES Ph.D. Thesis
Virendra Kumar Chaudhary 1977 136 p
Avail: Univ. Microfilms Order No. 78-08721

Fast converging series solutions for rectangular, parallelogram and triangular plate bending elements with arbitrary boundary conditions and arbitrary shapes, and subjected to generalized normal loading are developed. Solutions to parallelogram and rectangular plates are obtained by representing the deflected shape of a plate by a sequence of functions that are complete and satisfy the natural and forced boundary conditions. Solutions of triangular plates for simply supported and clamped boundary conditions are obtained in similar manner. Numerical results for deflections and bending movements were tabulated for different aspect ratios and skew angles. The numerical results indicate that the deflection functions developed for these shapes are very fast converging, and results of reasonable accuracy can be obtained by considering only first two or three harmonics.
Dissert. Abstr

N78-27450 Texas Univ. at Austin.
ANALYSIS OF CONTACT PROBLEMS USING VARIATIONAL INEQUALITIES Ph.D. Thesis
Noboru Kikuchi 1977 382 p
Avail: Univ. Microfilms Order No. 7807336

Three kinds of contact problems in elasticity are considered: Signorini's problems, which involves the deformation of a linearly elastic material supported unilaterally on rigid foundation, the rigid body punch problem, which involves the deformation on an elastic foundation indented by a rigid punch, and the two-body contact problem, which involves the deformation of two elastic bodies in contact. Existence theorems, uniqueness theorems, finite element approximations, convergence theorems for finite element approximations, and a priori error estimates are developed. In addition, several new solution methods are developed together with several new formulations which lead to effective solution methods. The results of several numerical experiments on representative problems are included. The numerical results confirm many of the theoretical predictions.
Dissert. Abstr.

N78-27451 Mississippi Univ., University.
CONTACT PROBLEMS OF RECTANGULAR ELASTIC BODIES WITH FINITE FRICTION INVOLVING SLIP Ph.D. Thesis
Gunvantprasad I. Prajapati 1977 86 p
Avail: Univ. Microfilms Order No. 7807986

The effect of friction is studied for rectangular elastic bodies subjected to compression and sliding means of rigid rough planes. The contact surface is divided into an inner adhesive zone in which the surface displacements are known, surrounded by two outer slip zones in which the normal and shear stresses are related by means of the coefficient of sliding friction. The problem was formulated using Papkovich-Fadle eigenfunctions which led to a set of three integral equations in terms of three unknown shear stress functions with complex kernels. These complex kernels were converted into real form by applying the calculus of residue. The shear stress in the outer slip zones was obtained by using Mindlin's approximation and the shear stress function in the adhesive zone was obtained by expansion in terms of Legendre polynomials of the unknown function. Dissert. Abstr.

N78-27452 Maryland Univ., College Park.
SECONDARY DEFLECTIONS AND LATERAL STABILITY OF BEAMS Ph.D. Thesis
Walter Lee Warnick 1977 259 p
Avail: Univ. Microfilms Order No. 7808187

For members whose properties can be described in terms of one independent variable such as beams and columns, a new formulation of equations describing their elastic behavior is derived by expressing the characteristics of the twisted member in a fixed coordinate system. This formulation leads to a re-interpretation of the lateral buckling of cantilevers of not-so-narrow rectangular cross-section, and to a unified approach to problems of transverse loading oblique to the principal axes of a cross-section. In addtiion several points in the cross-sections with certain types of asymmetry are shown to have special significance in connection with the torques due to the interactions of twist and either bending or axial loads. Dissert. Abstr.

N78-27453*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FRACTOGRAPHIC EVALUATION OF CREEP EFFECTS ON STRAIN-CONTROLLED FATIGUE-CRACKING OF AISI 304LC AND 316 STAINLESS STEEL
Robert E. Oldrieve Jun. 1978 22 p refs
(NASA-TM-78913; E-9648) Avail: NTIS HC A02/MF A01 CSCL 20K

Analysis of high temperature low cycle fatigue of AISI 304LC and 316 stainless steels by the method of strainrange partitioning results in four separate strainrange versus life relationships depending upon the way in which creep-strain and plastic strain are combined within a cycle. Fractography is used in this

investigation of the creep-fatigue interaction associated with these cycles. The PP and PC-cycle fractures were transgranular. The PC-cycle resulted in fewer cycles of initiation and shorter total cyclic life for the same applied inelastic strainrange. The CC-cycle had mixed transgranular and intergranular fracture, fewer cycles of initiation and shorter cycle life than PP or PC. The CP-cycle had fully integranular cracking, and failed in fewer cycles than were reqired for cracks to initate for PP,PC, and CC. Author

N78-27454# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

NOTCHED-FATIGUE BEHAVIOR TO 7075-BASE ALUMINUM ALLOYS Final Report, Jan. - Aug. 1976

Joseph S. Santern and Joseph F. Santner Feb. 1978 56 p refs

(AD-A053783; AFML-TR-77-78) Avail: NTIS HC A04/MF A01 CSCL 11/6

Then different alloys based on the 7075 composition were utilized to study the effects of purity level W/O Fe Si and dispersoid type on the notched fatigue behavior in two different environments. These same alloys were used in other AFML investigations to determine how the various precipitates found in commercial 7000 series aluminum alloys control the mechanical propertisive test environment. While the dispersoid type did change the macroscopic fracture appearance of the test specimen, this produced a small change in the notched fatigue life which was not significant at the one percent alpha level. By far, the test environment was more important than the metallurgical variables considered. This is somewhat surprising since the durtion of the tests were at most two days, allowing little time for corrosion. It appears that specifying stricture alloy purity levels or different dispersoid types will not improve the notched fatigue life of wroght 7000 series aluminum alloys. Author (GRA)

N78-27455# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.

LOAD AND ENVIRONMENT INTERACTIONS IN FATIGUE CRACK GROWTH UNDER SPECTRUM LOADING Final Report, 15 Jun. 1975 - 30 Sep. 1977

R. P. Wei Jan. 1978 82 p refs

(Grant AF-AFOSR-2857-75; AF Proj. 2307)

(AD-A053904; IFSM-78-88; AFOSR-78-0788TR) Avail: NTIS HC A05/MF A01 CSCL 11/6

The importance of delay (or, retardation in the rate of fatigue crack growth) produced by load interactions in variable-amplitude loading on the accurate prediction of fatigue lives of aircraft and other engineering structures has been recognized for some time and has begun to receive greater attention in recent years. Recent investigations showed that the effects of delay can be quite large, and that these effects need to be taken into account in developing improved fatigue analysis procedures for aircraft and other engineering structures. A number of models (based on the concepts of crack closure, residual stress intensity factor, etc.) have been proposed to account for the effects of delay. These models, while successfully predicting trends in the rate of fatigue crack growth for randomized load spectra, appear to break down for ordered spectra. Several basic problems contributed to the lack of complete success, and needs to be resolved in the development of improved models for predicting load interaction effects (chiefly delay) on fatigue crack growth. GRA

N78-27456# Naval Postgraduate School, Monterey, Calif.

FATIGUE CRACK PROPAGATION ANALYSIS OF AIRCRAFT STRUCTURES M.S. Thesis

Larry Don Newsome Mar. 1978 50 p refs

(AD-A053835) Avail: NTIS HC A03/MF A01 CSCL 01/3

This thesis is a comparative study of aircraft fatigue life calculations based upon crack propagation and upon cumulative damage. The stress concentration factor, which supplies sufficient geometric information for Miner's Law of cumulative damage, is found to not completely specify the geometry for the crack propagation approach. Effects on fatigue life of variations in initial crack length, plate width, hole size, and hole geometry for the same stress concentration factor have been investigated; also both ordered and random load histories were used to compare the two approaches. Complete FORTRAN computer program input documentation for the IBM 360/67 system has been included as an appendix to enable this thesis to serve as a user's manual for CRACK's II, an Air Force crack propagation program for aircraft fatigue damage. Author (GRA)

N78-27457# Florida Univ., Eglin AFB. Graduate Engineering Center.

STUDIES ON THE FAILURE OF STIFFENED CYLINDRICAL SHELLS SUBJECTED TO DYNAMIC LOADS Final Report, 1 Jan. - 31 Dec. 1977

C. A. Ross, R. L. Sierakowski, I. K. Ebcioglu, C. C. Schauble, and C. F. Yen 31 Dec. 1977 250 p refs

(Grant AF-AFOSR-3237-77)

(AD-A053954; AFOSR-78-0697TR) Avail: NTIS HC A11/MF A01 CSCL 20/11

The major objective of this study was to investigate the effects of axial stiffening of cylindrical shells subject to transverse blast loadings. Two existing methods for predicting dynamic response of cylindrical shells were modified to include axial stiffening. A semi-analytical energy method was chosen as a first cut design predictor and tables of normalized deflection versus external energy imparted to the structure are presented. In addition a more detailed analytical energy method was modified to include axial stiffening. In both cases the stiffeners were introduced by simply adding terms to the kinetic and potential energy terms of the basic shell equations rather than introducing membrane-bending coupling by use of more complicated anisotropic constitutive relations. The primary results of both methods indicate that the effect of axially stiffening a cylindrical shell using stiffeners typical of those in aerospace applications is very small. Both methods have been incorporated into computer algorithms which allow an investigator to determine failure modes of blast loaded shells either by an engineering approach or a more sophisticated detailed approach. Author (GRA)

N78-27458# Sandia Labs., Livermore, Calif. Test Projects Div.

B77 GTU-8D FULL SCALE STATIC LOAD TEST OF THINNED WALL TITANIUM AFTERBODY: SLL TEST NUMBER 7411-3

J. E. Vanderpoorten Dec. 1977 94 p

(Contract EY-76-C-04-0789)

(SAND-77-8291) Avail: NTIS HC A05/MF A01

Pertinent data of the GTU-8D afterbody static load tests are presented. GTU-8D is a thinned wall version of GTU-8A. Testing methods and load levels are similar. The aft case was first coated with photo stress material to determine the stress flow patterns and then subjected to lifting parachute loads of 200,000 lbs. axial and 50,000 lbs. side loading. ERA

N78-27459# Oak Ridge National Lab., Tenn.

EXPERIMENTAL STUDY OF PLASTIC RESPONSES OF PIPE ELBOWS

W. L. Greenstreet 20 Jan. 1978 59 p refs

(Contract W-7405-eng-26)

(ORNL/NUREG-24) Avail: NTIS HC A04/MF A01

Load deflection responses were determined experimentally for sixteen 152.4 mm commercial carbon steel pipe elbows and four 152.4 mm stainless steel elbows. Each specimen was loaded with an external force of sufficient magnitude to produce predominantly plastic response. The influences of bend radius and wall thickness were studied, as well as the effect of internal pressure on load deflection behavior. Comparisons of results from stainless steel and from carbon steel elbows indicate differences in responses attributable to material differences. The results were interpreted in terms of limit analysis concepts, and collapse loads were determined. Trends given by the collapse loads are identified and discussed. ERA

N78-27460# Brown Univ., Providence, R. I. Div. of Engineering.

NUMERICAL INVESTIGATION OF PLANE STRAIN STABLE CRACK GROWTH UNDER SMALL SCALE YIELDING CONDITIONS

E. P. Sorensen Sep. 1977 48 p refs Presented at ASTM Symp. on the Influence of Carbon, Nitrogen, and Residual Element Chemistry on the Behavior of Austenitic Stainless Steels used in Construction, Atlanta, 14 Nov. 1977

(Contract EY-76-S-02-3084)

(COO-3084-55- Conf-771140-3) . Avail: NTIS HC A03/MF A01

Plane strain crack advance under small scale yielding conditions in elastic-perfectly plastic and power law hardening materials was investigated numerically via the finite element method. Results indicate that the stress distribution ahead of a growing crack is essentially the same as that ahead of a stationary crack, and the numerically evaluated steady state crack tip profiles reflect a vertical tangent at the extending crack tip which corresponds to the theoretically predicted outline. It was found that the increment ddelta/sub t/ in crack tip opening, when loads are increased at fixed crack length, seems to be uniquely related to dJ/sigma o micron irrespective of the amount of previous crack growth, and for increments dl of crack advance at constant external load, this quantity appears related to J/sigma omicron r dl when evaluated at distance r from the tip. ERA

N78-27461# General Electric Co., Sunnyvale, Calif.
MODELLING THE TIME DEPENDENT NATURE OF STRUCTURAL RELIABILITY
G. L. Crellin and G. E. Ingram 1977 19 p Presented at Symp. on Application of Reliability Techniques to Nucl. Power Plants, Vienna, Austria, 10 Oct. 1977
(Contract EY-76-C-03-0893-013)
(GEFR-SP-050; Conf-7710108-2) Avail: NTIS HC A02/MF A01

The principles of structural reliability stress-strength theory are used to obtain a time dependent reliability. Constant and time dependent failure rates may then be derived. These rates are obtained in the absence of any direct time related phenomena and are the result only of interpreting the load distribution as being on the maximum load to be encountered. The failure rates are shown to be a function of the capability. As a result, whether a failure rate is constant, or time dependent, is determined by how time influences the capability. As the failure rate is a function of the capability, distributions on failure rate may be obtained through functional transforms of distributions describing the uncertainty about the capability. ERA

N78-27462# Battelle Pacific Northwest Labs., Richland, Wash.
FRACTURE MECHANICS OF THIN WALL CYLINDRICAL PRESSURE VESSELS: AN INTERIM REVIEW
R. J. Kurtz and N. J. Olson Aug. 1977 40 p refs
(Contract EY-76-C-06-1830)
(PNL-2417) Avail: NTIS HC A03/MF A01

Predictions relative to the length, direction, and rate growth of cladding rips subsequent to (or concurrent with) the initial cladding breach during unprotected transients were developed. Available fracture mechanics assessments relative to thin walled cylindrical pressure vessels were reviewed. Various fracture mechanics models were examined and pertinent fracture parameters are described. Reference materials for evaluating or developing experimental programs required to properly address the problem of predicting fracture behavior of material during transient events were provided. ERA

N78-27463# Washington Univ., St. Louis, Mo. Dept. of Civil Engineering.
DOCUMENTATION FOR THE SHORE-3 FINITE ELEMENT COMPUTER PROGRAM. PART 1: THEORETICAL MANUAL. PART 2: USERS' MANUAL Final Technical Report
P. K. Basu and Phillip L. Gould Sep. 1977 175 p refs
(Grant NSF ENV-76-06859)
(PB-277911/4; RR-48; NSF/RA-770406) Avail: NTIS HC A08/MF A01 CSCL 20K

The software designed for the static and dynamic analysis of axisymmetric shells and plates is described. The SHORE-3 program is written in FORTRAN 4 language. The users manual, explains how the SHORE-3 program can be used for the static and dynamic analysis of arbitrarily loaded thin elastic shells of revolution with or without column supports, in the elastic regime. The users manual describes the procedure to be followed in preparing the input data for this program and also assists in the interpretation of the output. A number of sample inputs and outputs using the various options of the program are included. GRA

42 GEOSCIENCES (GENERAL)

N78-27464*# Texas Univ. at Austin. Dept. of Geological Sciences.
THE CHANNELED SCABLAND
Victor R. Baker, ed. and Dag Nummedal, ed. (South Carolina Univ., Columbia) 1978 193 p refs Presented at the Comp. Planetary Geol. Field Conf., Columbia Basin, Wash., 5-8 Jun. 1978
(Grants NGR-44-012-194; NsG-7326; NsG-7076; NSF GA-21478)
(NASA-CR-157260) Avail: NTIS HC A09/MF A01 CSCL 08F

The geomorphology and hydrodynamics of high velocity flood erosion in the channeled scabland of the Columbia Basin are discussed. For individual titles, see N78-27465 through N78-27472.

N78-27465*# Texas Univ. at Austin. Dept. of Geological Sciences.
THE SPOKANE FLOOD CONTROVERSY c43
Victor R. Baker *In its* The Channeled Scabland 1978 p 3-15 refs (For primary document see N78-27464 18-42)
Avail: NTIS HC A09/MF A01 CSCL 08H

An enormous plexus of proglacial channels that eroded into the loess and basalt of the Columbia Plateau, eastern Washington is studied. This channeled scabland contained erosional and depositional features that were unique among fluvial phenomena. Documentation of the field relationships of the region explains the landforms as the product of a relatively brief, but enormous flood, then so-called the Spokane flood. G.G.

N78-27466*# Texas Univ. at Austin. Dept. of Geological Sciences.
QUATERNARY GEOLOGY OF THE CHANNELED SCABLAND AND ADJACENT AREAS c46
Victor R. Baker *In its* The Channeled Scabland 1978 p 17-35 refs (For primary document see N78-27464 18-42)
Avail: NTIS HC A09/MF A01 CSCL 08G

The quaternary history of the channeled scabland is characterized by discrete episodes of catastrophic flooding and prolonged periods of loess accumulation and soil formation. The loess sequence was correlated with Richmond's Rocky Mountain glacial chronology. At least five major catastrophic flood events occurred in the general vicinity of the channeled scabland. The earliest episode occurred prior to the extensive deposition of the Palouse formation. The last major episode of flooding occurred between about 18,000 and 13,000 years ago. It probably consisted of two outbursts from glacial Lake Missoula. G.G.

N78-27467*# Geological Survey, Menlo Park, Calif.
BEDROCK GEOLOGY OF THE NORTHERN COLUMBIA PLATEAU AND ADJACENT AREAS c46
Donald A. Swanson and Thomas L. Wright (Geol. Surv., Reston, Va.) *In* Texas Univ. at Austin The Channeled Scabland 1978 p 37-57 refs (For primary document see N78-27464 18-42)
Avail: NTIS HC A09/MF A01 CSCL 08G

The Columbia Plateau is surrounded by a complex assemblage of highly deformed Precambrian to lower Tertiary continental and oceanic rocks that reflects numerous episodes of continental accretion. The plateau itself is comprised of the Columbia River basalt group formed between about 16.5 x 1 million years B.P. and 6 x 1 million years B.P. Eruptions were infrequent between about 14 and 6 x 1 million years B.P., allowing time for erosion and deformation between successive outpourings. The present-day courses of much of the Snake River, and parts of the Columbia River, across the plateau date from this time. Basalt produced during this waning activity is more heterogeneous chemically and isotopically than older flows, reflecting its prolonged period of volcanism. G.G.

N78-27468*# Texas Univ. at Austin. Dept. of Geological Sciences.
PALEOHYDRAULICS AND HYDRODYNAMICS OF SCABLAND FLOODS c43

Victor R. Baker *In its* The Channeled Scabland 1978 p 59-79 refs (For primary document see N78-27464 18-42)
Avail: NTIS HC A09/MF A01 CSCL 08H

The last major episode of scabland flooding (approx. 18,000-13,000 years B.P.) left considerable high-water mark evidence in the form of: (1) eroded channel margins; (2) depositional features; (3) ice-rafter erratics; and (4) divide crossings. These were used to reconstruct maximum flood stages and water-surface gradients. Engineering hydraulic calculation procedures allowed the analyses of flood discharges and mean velocities from these data. Secondary flow phenomena, including various forms of vortices and flow separations, are considered to have been the principal erosive processes. The intense pressure and velocity gradients of vortices along the irregular channel boundaries produced the plucking-type erosion. G.G.

N78-27469*# Texas Univ. at Austin. Dept. of Geological Sciences.
LARGE-SCALE EROSIONAL AND DEPOSITIONAL FEATURES OF THE CHANNELED SCABLAND c46
Victor R. Baker *In its* The Channeled Scabland 1978 p 81-115 refs (For primary document see N78-27464 18-42)
Avail: NTIS HC A09/MF A01 CSCL 08G

The channeled scabland is a great anastomosing complex of highly overfit stand channels eroded into the basalt bedrock and overlying sediments of the Columbia Plateau. Both the erosional and depositional bed forms in these channels are described according to a simple hierarchical classification. The catastrophic flood flows produced macroforms (scale controlled by channel width) through the erosion of rock and sediment and by deposition (bars). Mesoforms (scale controlled by channel depth) are also erosional and depositional. G.G.

N78-27470*# Wesleyan Univ., Middletown, Conn. Dept. of Earth and Environmental Sciences.
ORIGIN OF THE CHENEY-PALOUSE SCABLAND TRACT c46
Peter C. Patton and Victor R. Baker (Texas Univ. at Austin) *In* Texas Univ. at Austin The Channeled Scabland 1978 p 117-130 refs (For primary document see N78-27464 18-42)
Avail: NTIS HC A09/MF A01 CSCL 08G

The Cheney-Palouse tract of the channeled scabland is the largest continuous tract of scabland in eastern Washington. The tract is composed of a varied assortment of bedrock erosional forms, loess islands, and gravel bars. Prominent bedrock longitudinal grooves and inner channels formed by macroturbulent plucking erosion of the jointed rock. Loess island forms vary as a function of their position within the flow. The three major types (submerged, partially submerged, and subaerially exposed) created sedimentologic conditions and resulting bar forms distinct from one another. Other bar forms, notably expansion bars, account for most of the sedimentation in the tract. G.G.

N78-27471*# South Carolina Univ., Columbia. Dept. of Geology.
FIELD TRIP STOP DESCRIPTIONS c46
Dag Nummedal *In* Texas Univ. at Austin The Channeled Scabland 1978 p 131-168 refs (For primary document see N78-27464 18-42)
Avail: NTIS HC A09/MF A01 CSCL 08G

Fifteen sites within the channeled scabland were selected as stops with the dual aim of visiting locations critical to the arguments for a catastrophic flood origin of the scablands, as well as permitting an examination of the variability in both erosional and depositional features. The stop locations are plotted on a generalized geologic map and their coordinates are given in table form. G.G.

N78-27472*# South Carolina Univ., Columbia. Dept. of Geology.
AERIAL FIELD GUIDE c46
Dag Nummedal *In* Texas Univ. at Austin The Channeled Scabland 1978 p 169-177 refs (For primary document see N78-27464 18-42)
Avail: NTIS HC A09/MF A01 CSCL 08G

There are two overflights planned for the field conference; one for the Cheney-Palouse tract of the eastern channeled scabland, the other covering the coulees and basins of the western region. The approximate flight lines are indicated on the accompanying LANDSAT images. The first flight will follow the eastern margin of this large scabland tract, passing a series of loess remnants, gravel bars and excavated rock basins. The western scablands overflight will provide a review of the structurally controlled complex pattern of large-scale erosion and deposition characteristic of the region between the upper Grand Coulee (Banks Lake) and the Pasco Basin. G.G.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N78-27473 Maryland Univ., College Park.
LINEAR FEATURE DETECTION AND MAPPING Ph.D. Thesis
Gordon James VanderBrug 1977 263 p
Avail: Univ. Microfilms Order No. 78-08196

The methods developed are applicable to many types of pictures, but the examples used in the dissertation are all taken from remote sensory imagery. In such imagery, roads, rivers, and geologically significant structures known as lineaments all appear as linear features. The approach taken involves several steps: (1) detection of the features on a local basis using a local matching process; (2) iterative enhancement of the local feature detection output using contextual information; (3) representation of the resulting curve segments in a data structure; and (4) merging the segments, as guided by the data structure, to yield global linear features. Dissert. Abstr.

N78-27474*# Agricultural Research Service, Weslaco, Tex.
PLANT COVER, SOIL TEMPERATURE, FREEZE, WATER STRESS, AND EVAPOTRANSPIRATION CONDITIONS Quarterly Progress Report, 1 Mar. - 1 Jun. 1978
Craig L. Wiegand, Paul R. Nixon, Harold W. Gausman, L. Neal Namken, Ross W. Leamer, and Arthur J. Richardson, Principal Investigators Jun. 1978 5 p ERTS
(NASA Order S-40198-B)
(E78-10144; NASA-CR-157231) Avail: NTIS HC A02/MF A01 CSCL 08F

There are no author-identified significant results in this report.

N78-27475*# South Dakota State Univ., Brookings. Remote Sensing Inst.
HCMM ENERGY BUDGET DATA AS A MODEL INPUT FOR ASSESSING REGIONS OF HIGH POTENTIAL GROUNDWATER POLLUTION Interim Report, Apr. - Jun. 1978
Donald G. Moore, Principal Investigator, J. Heilman, J. Tunheim, and V. Baumberger Jun. 1978 14 p ERTS
(Contract NAS5-2406)
(E78-10145; NASA-CR-157232) Avail: NTIS HC A02/MF A01 CSCL 13B

The author has identified the following significant results. To investigate the general relationship between surface temperature and soil moisture profiles, a series of model calculations were carried out. Soil temperature profiles were calculated during a complete diurnal cycle for a variety of moisture profiles. Preliminary results indicate the surface temperature difference between two sites measured at about 1400 hours is related to the difference in soil moisture within the diurnal damping depth (about 50 cm). The model shows this temperature difference to vary considerably throughout the diurnal cycle.

N78-27476*# Geological Survey, Denver, Colo.
GEOLOGIC APPLICATION OF THERMAL-INERTIA MAPPING FROM SATELLITE Progress Report, 1 Mar. - 31 May 1978
Terry W. Offield, Principal Investigator, Susanne H. Miller, and Kenneth Watson Jun. 1978 5 p Sponsored by NASA ERTS
(E78-10146; NASA-CR-157233) Avail: NTIS HC A02/MF A01 CSCL 08B

The author has identified the following significant results: A

theoretical evaluation of the proportional and linear relationship between absolute and relative thermal inertia was performed, and a potentially more accurate expression for absolute thermal inertia mapping was proposed.

N78-27477*# Environmental Research and Technology, Inc., Concord, Mass.
INVESTIGATION OF THE APPLICATION OF HCMM THERMAL DATA TO SNOW HYDROLOGY Quarterly Progress Report, 1 Apr. - 30 Jun. 1978
James C. Barnes, Principal Investigator 30 Jun. 1978 4 p ERTS
(Contract NAS5-24316)
(E78-10147; NASA-CR-157234; QPR-3) Avail: NTIS HC A02/MF A01 CSCL 08L
There are no author-identified significant results in this report.

N78-27478*# Department of Industry, London (England).
THE USE OF LANDSAT IMAGERY IN RELATION TO AIR SURVEY IMAGERY FOR TERRAIN ANALYSIS IN NORTH-WEST QUEENSLAND, AUSTRALIA, VOLUME 1 Final Report
Monica M. Cole and E. Stuart Owen-Jones, Principal Investigators 15 Dec. 1977 161 p refs Sponsored by NASA ERTS 3 Vol.
(E78-10148; NASA-CR-157242) Avail: NTIS HC A08/MF A01 CSCL 08B
The author has identified the following significant results. Distinctive spectral signatures discriminated areas underlain by distinctive lithological/stratigraphical units where bedrock either outcrops or is relatively near to surface in the Lady Annie-Mt. Gordon fault zone, the Mary Kathleen, and Dugald River-Naraku areas. Spectral signatures associated with discrete plant communities distinguished different types of superficial deposits over the Cloncurry Plains. Distinctive spectral signatures also revealed the presence and nature of concealed bedrock beneath cover of residuum and superficial deposits where this is relatively thin in the Cloncurry Plains. Major faults were clearly displayed in areas of outcropping and near surface bedrock. Sets of lineaments with preferred orientations were identified in the Lady Annie and Dugald River areas. Known base metal deposits occur along these features.

N78-27479*# Department of Industry, London (England).
THE USE OF LANDSAT IMAGERY IN RELATION TO AIR SURVEY IMAGERY FOR TERRAIN ANALYSIS IN NORTH-WEST QUEENSLAND, AUSTRALIA, VOLUME 2 Final Report
Monica M. Cole and E. Stuart Owen-Jones, Principal Investigators 15 Dec. 1977 135 p Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS 3 Vol.
(E78-10149; NASA-CR-157243) Avail: NTIS HC A07/MF A01 CSCL 08B
There are no author-identified significant results in this report.

N78-27480*# Department of Industry, London (England).
THE USE OF LANDSAT IMAGERY IN RELATION TO AIR SURVEY IMAGERY FOR TERRAIN ANALYSIS IN NORTH-WEST QUEENSLAND, AUSTRALIA, VOLUME 3 Final Report
Monica M. Cole and E. Stuart Owen-Jones, Principal Investigators 15 Dec. 1977 73 p Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS 3 Vol.
(E78-10150; NASA-CR-157244) Avail: NTIS HC A04/MF A01 CSCL 08B
There are no author-identified significant results in this report.

N78-27481*# Columbia Univ., New York. Dept. of Geography.
APPLICATION OF DIGITAL ANALYSIS OF MSS DATA TO AGRO-ENVIRONMENTAL STUDIES Semiannual Progress Report, 1 Sep. 1977 - 31 Mar. 1978
Kempton E. Webb, Colin J. High, Jerry C. Coiner, and Leonard Zobler, Principal Investigators 1 Apr. 1978 132 p refs ERTS
(Grant NsG-5080)
(E78-10151; NASA-CR-157245) Avail: NTIS HC A07/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N78-27482*# Georgia Southwestern Coll., Americus.
INTRODUCTORY WORKSHOPS ON REMOTE SENSING AS RELATED TO GEOLOGICAL PROBLEMS IN GEORGIA Final Report
Barry F. Beck and Jack C. Carter, Principal Investigators Mar. 1978 23 p refs Workshop held at Americus, Ga., 24-25 May 1977 ERTS
(Contract NAS8-30884)
(E78-10152; NASA-CR-150710) Avail: NTIS HC A02/MF A01 CSCL 08G
There are no author-identified significant results in this report.

N78-27483*# Colorado State Univ., Fort Collins. Dept. of Earth Resources.
THE POTENTIAL BENEFIT OF IMPROVING THE DISSEMINATION OF AGRICULTURAL WEATHER INFORMATION TO THE MISSISSIPPI COTTON FARMER Final Report
Kenny Thomas Priddy and William E. Marlatt, Principal Investigators Jun. 1978 89 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 571-98 ERTS
(Grant NsG-5073)
(E78-10153; NASA-CR-157246) Avail: NTIS HC A05/MF A01 CSCL 04B
The author has identified the following significant results. The potential benefit of improved dissemination of weather information to the Mississippi cotton farmer was estimated at $36,000 per 1000 acres. This is 16% of production cost of cotton in 1976. On a statewide basis, the total potential savings exceeds 100 million dollars.

N78-27484*# Kansas Univ. Center for Research, Inc., Lawrence.
THE APPLICATION OF REMOTE SENSING TO RESOURCE MANAGEMENT AND ENVIRONMENTAL QUALITY PROGRAMS IN KANSAS Annual Report, 1 Apr. 1978 - 31 Mar. 1978
B. G. Barr and E. A. Martinko, Principal Investigators Jul. 1978 90 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 571-98 ERTS
(Grant NGL-17-004-024)
(E78-10154; NASA-CR-157247) Avail: NTIS HC A05/MF A01 CSCL 13B
There are no author-identified significant results in this report.

N78-27485*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SEASAT-A SATELLITE SCATTEROMETER (SASS) VALIDATION AND EXPERIMENT PLAN
Lyle C. Schroeder, ed. May 1978 106 p refs
(NASA-TM-78751) Avail: NTIS HC A06/MF A01 CSCL 14B
This plan was generated by the SeaSat-A satellite scatterometer experiment team to define the pre-and post-launch activities necessary to conduct sensor validation and geophysical evaluation. Details included are an instrument and experiment description/performance requirements, success criteria, constraints, mission requirements, data processing requirement and data analysis responsibilities. J.A.M.

N78-27486*# Delaware Univ., Newark. College of Marine Studies.
SKYLAB/ERAP APPLICATION TO ECOLOGICAL, GEOLOGICAL, AND OCEANOGRAPHIC INVESTIGATIONS OF DELAWARE BAY Final Report, Jun. 1973 - Mar. 1976
Vytautas Klemas, D. Bartlett, W. Philpot, R. Rogers (Bendix Aerospace Systems Div., Ann Arbor, Mich.), and L. Reed (Bendix Aerospace Systems Div., Ann Arbor, Mich.) Jun. 1978 68 p refs

(Contract NAS1-12304)
(NASA-CR-144910; CMS-NASA-1-76) Avail: NTIS HC A04/MF A01 CSCL 08C

Skylab/EREP S190A and S190B film products were optically enhanced and visually interpreted to extract data suitable for: (1) mapping coastal land use; (2) inventorying wetlands vegetation; (3) monitoring tidal conditions; (4) observing suspended sediment patterns; (5) charting surface currents; (6) locating coastal fronts and water mass boundaries; (7) monitoring industrial and municipal waste dumps in the ocean; (8) determining the size and flow direction of river, bay and man-made discharge plumes; and (9) observing ship traffic. Film products were visually analyzed to identify and map ten land-use and vegetation categories at a scale of 1:125,000. Digital tapes from the multispectral scanner were used to prepare thematic maps of land use. Classification accuracies obtained by comparison of derived thematic maps of land-use with USGS-CARETS land-use maps in southern Delaware ranged from 44 percent to 100 percent. G.G

N78-27487*# Vought Corp., Hampton, Va.
SEGREGATION OF ACID PLUME PIXELS FROM BACKGROUND WATER PIXELS, SIGNATURES OF BACKGROUND WATER AND DISPERSED ACID PLUMES, AND IMPLICATIONS FOR CALCULATION OF IRON CONCENTRATION IN DENSE PLUMES
Gilbert S. Bahn May 1978 62 p
(Contract NAS1-13500)
(NASA-CR-145372) Avail: NTIS HC A04/MF A01 CSCL 08H

Two files of data, obtained with a modular multiband scanner, for an acid waste dump into ocean water, were analyzed intensively. Signatures were derived for background water at different levels of effective sunlight intensity, and for different iron concentrations in the dispersed plume from the dump. The effect of increased sunlight intensity on the calculated iron concentration was found to be relatively important at low iron concentrations and relatively unimportant at high values of iron concentration in dispersed plumes. It was concluded that the basic equation for iron concentration is not applicable to dense plumes, particularly because lower values are indicated at the very core of the plume, than in the surrounding sheath, whereas radiances increase consistently from background water to dispersed plume to inner sheath to innermost core. It was likewise concluded that in the dense plume the iron concentration would probably best be measured by the higher wave length radiances, although the suitable relationship remains unknown. G.Y.

N78-27488*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A PROPOSED TEST AREA FOR THE SPACEBORNE GEODYNAMIC RANGING SYSTEM
Paul D. Lowman, Jr. Jul. 1978 15 p refs Presented at the SGRS Spaceborne Laser Ranging Workshop, Texas Univ., Austin, 17-21 Jul. 1978
(NASA-TM-79592) Avail: NTIS HC A02/MF A01 CSCL 08B

Precise geodetic measurements are proposed in which an orbiting laser obtains intersite distance between retroreflectors 25 to 100 km apart on the ground. The recommended area is a rectangle 200 by 400 km in southern California and adjacent Nevada, trending northeast. It includes the entire width of the San Andreas fault zone, the Garlock fault, the thrust faults of the Transverse Ranges, and the active strike-slip faults of the Mojave Desert. G.G.

N78-27489*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REFLECTION SPECTRA AND MAGNETOCHEMISTRY OF IRON OXIDES AND NATURAL SURFACES
Peter Wasilewski May 1978 44 p refs Submitted for publication
(NASA-TM-79556) Avail: NTIS HC A03/MF A01 CSCL 20F

The magnetic properties and spectral characteristics of iron oxides are distinctive. Diagnostic features in reflectance spectra (0.5 to 2.4 micron) for alpha Fe2O3, gamma Fe2O3, and FeOOH include location of Fe3(+) absorption features, intensity ratios at various wavelengths, and the curve shape between 1.2 micron and 2.4 micron. The reflection spectrum of natural rock surfaces are seldom those of the bulk rock because of weathering effects. Coatings are found to be dominated by iron oxides and clay. A simple macroscopic model of rock spectra (based on concepts of stains and coatings) is considered adequate for interpretation of LANDSAT data. The magnetic properties of materials associated with specific spectral types and systematic changes in both spectra and magnetic properties are considered. G.G.

N78-27490*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF SOME DETERGENTS, HUMATE, AND COMPOSITION OF SEEDBED ON CROP OF TOMATO PLANTS IN A HYDROPONIC CULTURE
Z. Guminka, M. Gracz-Nalepka, B. Lukasiewicz, E. Sobolewicz, and I. T. Turkiewicz Jun. 1978 15 p refs Transl. into ENGLISH from Acta Agrobotan. (Poland), vol. 28, no. 2, 1975 p 205-215 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Wroclaw Univ., Poland
(Contract NASw-2790)
(NASA-TM-75319) Avail: NTIS HC A02/MF A01 CSCL 02C

It is established that single detergent doses distinctly stimulate vegetative development of plants in the initial stage when humates are available. When detergents are applied every four weeks in a hydroponic culture, in which the seedbed does not contain active humates, the crop is reduced by 50%. This adverse effect does not occur when the seedbed is a mixture of brown coal and peat. Author

N78-27491# Geological Survey, Lakewood, Colo.
WATER RESOURCES DATA FOR COLORADO, WATER YEAR 1976. VOLUME 2. COLORADO RIVER BASIN Annual Report, 1 Oct. 1975 - 30 Sep. 1976
1977 704 p refs
(PB-278780/2; USGS/WRD/HD-77/050; USGS/WDR/CO-76/2) Avail: NTIS HC A99/MF A01 CSCL 13B

Water-resources data for Colorado for the 1976 water year consists of records of stage, discharge, and water quality of streams; stage, contents; and water quality of lakes and reservoirs, and water levels and water quality of wells and springs. This report contains discharge records for 404 gaging stations, stage and contents of 24 lakes and reservoirs, 5 partial-record flow stations, 79 crest-stage partial-record stations, and 193 miscellaneous sites; water quality for 103 gaging stations and 60 miscellaneous sites; and water levels for 60 observation wells. A few pertinent stations in bordering states are also includes in this report. These data respresent that portion of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Colorado GRA

N78-27492# Geological Survey, Cheyenne, Wyo. Water Resources Div.
WATER RESOURCES DATA FOR WYOMING, WATER YEAR 1976. VOLUME 1. MISSOURI RIVER BASIN Annual Report, 1 Oct. -1975 - 30 Sep. 1976
Dec. 1977 644 p Prepared in cooperation with Wyoming state Dept. of Environmental Quality, Cheyenne, Bureau of Land Manag., Wash., D.C., Corps of Eng., Wash. D.C., and National Park Service, Wash. D.C.
(PB-278818/0; USGS/WRD/HD-77/063; USGS/WDR/WG-76-1) Avail: NTIS HC A99/MF A01 CSCL 13B

Water resources data for the 1976 water year for Wyoming consists of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of wells. Discharge records for 226 gaging stations are presented. GRA

N78-27493# Washington Univ., Seattle. Dept. of Mining, Metallurgical, and Ceramic Engineering.
APPENDIX: COOK INLET COAL: ECONOMICS OF MINING AND MARINE SLURRY TRANSPORT Final Report
Brian David Hennagin 5 Jan. 1978 97 p refs
(Contract DI-BM-GO-264012)
(PB-278756/2; BM-OFR-17(2)-78) Avail: NTIS HC A05/MF A01 CSCL 08I

Beluga coal deposits on Cook Inlet, Alaska are described, and mining and transport costs to move the coal to a potential

steam-electric plant site in northern Washington as a marine slurry are evaluated. A surface mine site was chosen 15 miles from tidewater. The coal is mined, washed, slurried, and transported by pipeline to tidewater where it is loaded aboard ship as a settled marine slurry. The coal is carried by ship to northern Washington, reslurried and pumped off the ship to dewatering facilities. Costs for mining, washing, preparation, transport, and dewatering are developed per ton of clean coal and final costs per million BTU's. Production rates are evaluated to fuel 1000 and 2000 MW plants with 80% annual output factor. GRA

N78-27494# Army Engineer Topographic Labs., Fort Belvoir, Va.
INVESTIGATION OF THE APPLICATION OF ARRAY OF ALGEBRA TO TERRAIN MOD
James R. Jancaitis and Ronald L. Magee Apr. 1978 59 p refs
(AD-A054007; ETL-0141) Avail: NTIS HC A04/MF A01 CSCL 08/2

This report investigates the application of array algebra to ETL's terrain modeling procedure in the following manner: analyze array algebra to verify specifically the equivalence of array algebra and the conventional least-squares solutions; analytically and empirically compare the computational efficiency of ETL's terrain modeling algorithm using the current least-squares method and the array algebra technique and investigate the applicability of Rauhala's array algebra to the ETL terrain modeling algorithm. The results showed that the array algebra algorithm is computationally equivalent to the least squares algorithm but has higher implementational overhead. The array algebra algorithm is also less efficient for the ETL terrain modeling problem. GRA

N78-27495# Army Engineer Topographic Labs., Fort Belvoir, Va.
ELEVATION DATA COMPACTION BY POLYNOMIAL MODELING
James R. Jancaitis Apr. 1978 47 p refs
(AD-A054003; ETL-0140) Avail: NTIS HC A03/MF A01 CSCL 08/2

This report details the status of ongoing research directed towards development of a near-term production implementation of digital data compression of terrain elevation information. The first section discusses the important data characteristics, the major applications, and the compression needs. The second section discusses the various published terrain representations, their capabilities and limitations. The third section presents an overview of the Polynomial Terrain Model's characteristics and construction. The next section contained the development plan identified for production implementation of the polynomial modeling technique, and the remaining sections report on the status of various phases of this development. The results showed that the Polynomial Matrix method is the most promising of the various digital terrain formats (DFT). Author (GRA)

N78-27496# Naval Surface Weapons Center, Dahlgren, Va.
NSWC/DL FILTERING OF GEOS-3 RADAR ALTIMETRY DATA Final Report
G. B. West, T. I. Hicks, and R. B. Manrique Nov. 1977 54 p refs
(AD-A053957; NSWC/DL-TR-3686) Avail: NTIS HC A04/MF A01 CSCL 22/2

The along-track geoid heights and vertical deflections over the oceans are estimated by a Wiener filter based on The Analytic Sciences Corporation (TASC) Model with pre-filter parameters derived from an analysis of the GEOS-3 satellite radar altimetry data. A study of 81 passes (716 intersections) of the radar altimetry data from the Perth, Australia telemetry site shows a mean geoid height difference of 0.75 m and a standard deviation of 2.33 m before bias removal, and a mean geoid height of -0.06 m and a standard deviation of 0.53 m after bias removal. The geoidal contours derived from this data reveal known geoidal features in regions where ship surveys are available. Author (GRA)

N78-27497# Boise State Univ. Idaho.
GEOTHERMAL POTENTIAL OF THE WEST BOISE AREA
L. L. Mink and D. L. Graham Oct. 1977 40 p refs
(Contract EY-76-C-07-1570)
(TREE-1162) Avail: NTIS HC A03/MF A01

Recent investigations in the Boise area shows that hot water is abundant all along the Boise Foothills. Two areas showing good potential for future geothermal development are discussed. These areas are the Dry Greek Valley and the area between Pierce Gulch and Polecat Gulch. Both areas have water temperatures exceeding 37.8 C. In the Boise area it is found tht zones of hot water are associated with some type of structural control. The hot water zones associated with the Dry Creek Valley and the Pierce-Polecat area were found to be located at or near the intersection of major linears mapped along the Boise Foothills. By mapping all known fault and linear patterns in the area, it is possible to correlate these zones of weakness with areas of hot water. At the intersection of two or more linears, where fracturing is greatest the majority of geothermal water was located. ERA

N78-27498# City of Long Beach, Calif.
PILOT DEMONSTRATION OF ENHANCED OIL RECOVERY BY MICELLAR POLYMER WATERFLOODING, PHASE B Monthly Report, Oct. 1977
J. E. Wade 10 Nov. 1977 9 p refs
(Contract EF-77-C-03-1395)
(SAN/1395-15) Avail: NTIS HC A02/MF A01

A second stage of the transient test was undertaken. The early pulse tests were complicated by operational difficulties resulting in data that was difficult to interpret. Progress was made on flooding the fresh core material obtained from frozen cores. Preliminary results are very encouraging. Work continued on the facilities for the mini-injectivity test. ERA

N78-27499# Columbia Gas Transmission Corp., Charleston, W. Va.
TERTIARY OIL RECOVERY BY CO2 INJECTION Monthly Report, Nov. 1977
W. D. Conner 1977 23 p refs
(Contract EF-76-C-05-5302)
(ORO-5302-20) Avail: NTIS HC A02/MF A01

Water injection for November was approximately 5530 barrels, which was a slight increase over the 5440 barrels injected during October. Down time of 24 hours was considerably lower than previous months. Mechanically, the project proceeded almost as scheduled except for minor adjustments of the high pressure shutdown switch on the injection pump. Oil production, however, continued to be disappointing. Total production again declined approximately 200 barrels to 1525. Although it was necessary to service one well, most of the production decline follows the trend of recent months. Total production due to CO2 injection is 8151 barrels. A request was received to allow an environmental assessment team to inspect the project. ERA

N78-27500# Los Alamos Scientific Lab., N. Mex.
MAPPING OFFSHORE OIL LEASES
J. L. Sibert 1978 8 p refs Presented at a Joint Meeting of Am. Congr. on Surveying and Mapping and Am. Soc. for Photogrammetry, Washington, D.C., 26 Feb. 1978
(Contract W-7405-eng-36)
(LA-UR-77-2892; Conf-780209-1) Avail: NTIS HC A02/MF A01

A data base query system developed as a tool for regulatory decision making is described. The legal description of each lease, based on the public and survey, is stored in the data base to provide the coordinates necessary for map production. Maps are produced interactively during a query session on a Tektronix 4014 graphics terminal. Hardcopy color maps are obtained by using a color-equipped FR-80 computer output microfilm recorder. The procedure is totally automated and is completely handled from a remote terminal. Several examples of queries and the maps they produce are presented. Other aspects of the data base retrieval system discussed include a network structure based on the CODASYL standard and a query language that allows complex retrievals to be specified in simple english phrases. ERA

N78-27501# National Technical Information Service, Springfield, Va.
PUBLIC OPINION AND SOCIOLOGY OF WATER RESOURCE DEVELOPMENT. A BIBLIOGRAPHY WITH ABSTRACTS

Progress Report, 1970 - May 1978
Edward J. Lehmann May 1978 199 p Supersedes NTIS/PS-77/0432; NTIS/PS-76/0397; NTIS/PS-75/373
(NTIS/PS-78/0437/0; NTIS/PS-77/0432; NTIS/PS-76/0397; NTIS/PS-75/373) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

The citations give insight into the feelings of citizens and officials toward water resource programs involving water quality management, reservoirs, irrigation, and drinking water. The effects of water resource development on the social conditions of a region or a community are also presented. GRA

N78-27502# Geological Survey, Baton Rouge, La. Water Resources Div.
WATER RESOURCES DATA FOR LOUISIANA, WATER YEAR 1977. VOLUME 1: CENTRAL AND NORTHERN LOUISIANA Annual Water Data Report, 1 Oct. 1976 - 30 Sep. 1977
Dec. 1977 415 p refs 3 Vol.
(PB-278868/5; USGS/WRD/HD-77/060-Vol-1; USGS/WRD/LA-77-1) Avail: NTIS HC A18/MF A01; also available in set of 3 reports HC E17, PB-278867-SET CSCL 13B

Water resources data for the 1977 water year for Louisiana consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. Discharge records for 72 gaging stations; stage records for 66 of these gaging stations; stage only for 30 gaging stations; contents for 1 reservoir; stage only for 10 lakes; water quality for 148 stations; 27 of these at gaging stations; 215 areal stations, 20 lakes, and 174 wells; and water levels for 696 observation wells are presented. Also included are 199 crest-stage partial record stations and flood profile partial record stations. GRA

N78-27503# Geological Survey, Baton Rouge, La. Water Resources Div.
WATER RESOURCES DATA FOR LOUISIANA, WATER YEAR 1977. VOLUME 2: SOUTHERN LOUISIANA Annual Water Data Report, 1 Jan. 1976 - 30 Sep. 1977.
Dec. 1977 401 p refs 3 Vol.
(PB-278869/3; USGS/WRD/HD-77/062-Vol-2; USGS/WDR/LA-77/2) Avail: NTIS HC A18/MF A01; also available in set of 3 reports HC E17, PB-278867-SET CSCL 13B

Data consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. Also included are 199 crest-stage partial-record stations and flood-profile partial-record stations. Records for a few pertinent stations in bordering States are also included in this report.GRA

N78-27504# Geological Survey, Baton Rouge, La. Water Resources Div.
WATER RESOURCES DATA FOR LOUISIANA, WATER YEAR 1977. VOLUME 3: COASTAL LOUISIANA Annual Water Data Report, 1 Oct. 1976 - 30 Sep. 1977
Dec. 1977 586 p refs 3 Vol.
(PB-278870/1; USGS/WRD/HD-77/061-Vol-3; USGS/WDR/LA-77/3) Avail: NTIS HC A25/MF A01; also available in set of 3 reports HC E17, PB-278867-SET CSCL 13B

For abstract, see N78-27503.

N78-27505# Geological Survey, Tallahassee, Fla. Resources Div.
WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1976. VOLUME 1: NORTHEAST FLORIDA, SURFACE WATER, GROUND WATER, QUALITY OF WATER Annual Report, 1 Oct. 1975 - 30 Sep. 1976
Sep. 1977 592 p
(PB-278767/9; USGS/WRD/HD-77/042-Vol-1; USGS/WRD/FL-76/1-Vol-1) Avail: NTIS HC A25/MF A01 CSCL 13B

Discharge records for 59 streams, stage-only records for 12 streams, elevations for 67 lakes, and daily water level measurements for 98 wells are reported. Water quality data for approximately 220 surface sites and 700 wells are included, as are 2 miscellaneous measurements, 25 crest-stage partial records, and 8 annual maximum flood profile measurements. These data represent the National Water Data System records collected by the U.S. Geological Survey and cooperating local, state and federal agencies in Florida. GRA

N78-27506# Geological Survey, Tallahassee, Fla. Water Resources Div.
WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1976. VOLUME 4: NORTHWEST FLORIDA Annual Report, 1 Oct. 1975 - 30 Sep. 1976
Sep. 1977 530 p
(PB-278768/7; USGS/WRD/HD-77/051-Vol-4; USGS/WDR/FL-76/4) Avail: NTIS HC A23/MF A01 CSCL 13B

Water resources data for the 1976 water year in northwest Florida consists of discharge records for 84 streams, elevations for 27 lakes, and daily water level measurements for 110 wells. Water quality data for approximately 220 surface sites and 170 wells are included; as are miscellaneous measurement and crest-stage partial records. These data represent the National Water Data System records collected by the U.S. Geological Survey and cooperating local, state and federal agencies in Florida. GRA

N78-27507# Texas Univ. at Dallas, Richardson. Center for Environmental Studies.
SUMMARY ANALYSIS OF THE NORTH AMERICAN (US PORTION) OECD EUTROPHICATION PROJECT: NUTRIENT LOADING-LAKE RESPONSE RELATIONSHIPS AND TROPHIC STATE INDICES Final Report, Jul. 1974 - Nov. 1977
Walter Rast and Fred G. Lee Jan. 1978 479 p refs
(Grants EPA-R-803356-01-0; EPA-R-803356-01-3)
(PB-278984/0; EPA-600/3-78-008) Avail: NTIS HC A21/MF A01 CSCL 13B

Critical analysis is given of nutrient load-lake response relationships for 38 U.S. water bodies which have been intensively studied by 20 scientists participating in the OECD Eutrophication Program. It was determined that the Vollenweider nutrient load relationship involving mean depth, hydraulic residence time and phosphorus load correlated well with the trophic states assigned by the individual investigators. The relationships developed in this study can be used to predict the improvement in water quality that will result from a change in the phosphorus load to a water body for which phosphorus is the key chemical element limiting planktonic algal growth. GRA

N78-27508# National Oceanic and Atmospheric Administration, Washington, D. C. Center for Experiment Design and Data Analysis.
US IFYGL SHIP SYSTEM: DESCRIPTION OF ARCHIVED DATA
Robert E. Dennis Jan. 1978 68 p
(PB-278830/5; NOAA-TR-EDS-27; NOAA-78022102) Avail: NTIS HC A04/MF A01 CSCL 08H

A description is given of the data collected aboard the U.S. ships RESEARCHER and ADVANCE II during the International Field Year for the Great Lakes (IFYGL), a joint United States-Canadian program conducted in 1972-73 for the study of Lake Ontario and its basin. Sensors, data acquisition systems, and data processing procedures are discussed, and inventories are given of the archived data. GRA

N78-27509# Geological Survey, Tallahassee, Fla. Water Resources Div.
METHODS OF ESTIMATING RECHARGE TO THE FLORIDAN AQUIFER IN NORTHEAST FLORIDA
G. G. Phelps Feb. 1978 24 p refs Prepared in cooperation with the City of Jacksonville, Fla.
(PB-278855/2; USGS/WRD/WRI-78/020) Avail: NTIS HC A02/MF A01 CSCL 08H

Recharge to the principal artesian aquifer in a six-county area in northeast Florida was calculated using closed contour methods, water budgets, and formulas for computing leakage through confining beds. Each estimate was then tested in a computer model of groundwater flow to see which estimate was best. GRA

N78-27510# Geological Survey, Raleigh, N. C. Water Resources Div.
GROUND-WATER RESOURCES ALONG THE BLUE RIDGE PARKWAY, NORTH CAROLINA
M. D. Winner, Jr. Sep. 1977 180 p refs Prepared in cooperation with the US National Park Service
(PB-279051/7; USGS/WRI-77/65; USGS/WRD/WRI-78/021) Avail: NTIS HC A09/MF A01 CSCL 08H

The best areas to develop ground water along the Blue Ridge Parkway in North Carolina are in broad draws and in stream valleys where draws open to the valleys. Saprolite thickness in these places can exceed 50 feet and provide adequate groundwater storage; draws are topographic expressions of fracture zones in the underlying bedrock, which transmit water from the overlying saprolite to the wells. Well yields along the Parkway can exceed 25 gallons per minute. 'Good' areas for wells, 'fair' areas for wells, and inferred fracture zones are shown on a series of topographic maps of the Parkway, and are based upon an assessment of the topography and saprolite thickness in each map area. The text that accompanies each map describes the geology of the area, recreational and associated facilities along the Parkway, well and spring data, and potential yields of wells. GRA

N78-27511# Bureau of Mines, Washington, D. C.
ADVANCING COAL MINING TECHNOLOGY RESEARCH, DEVELOPMENT, AND DEMONSTRATION IN FISCAL YEAR 1977 Information Circular, 1 Oct. 1976 - 30 Sep. 1977
1977 18 p
(PB-278001/3; BM-IC-8730) Avail: NTIS HC A02/MF A01 CSCL 08I

The publication summarizes, for potential contractors and other interested parties, the proposed research, development, and demonstration contract projects programmed by the Bureau of Mines for fiscal year 1977 (October 1, 1976 - September 30, 1977) under its Advancing Coal mining Technology program. The objective of these projects is to provide an ordered and sequenced series of advances toward the overall goal of providing the system technology required to increase the productivity of the coal mining process. GRA

N78-27512# National Geodetic Survey, Rockville, Md.
USE OF CALIBRATION BASE LINES
Charles J. Fronczek Dec. 1977 44 p refs
(PB-279574/8; NOAA-TM-NOS-NGS-10; NOAA-78021005) Avail: NTIS HC A03/MF A01 CSCL 08E

During the early 1970's, the number and types of electronic distance measuring instruments (EDMI) dramatically increased. Their use was expanded to cover almost every conceivable surveying problem. Quality assurance became a pressing concern. But, unlike tape or wire standardization, no recognized agency or organization was responsible for calibration standards for EDMI. Therefore, in 1974, the National Geodetic Survey of the National Ocean Survey began establishing a series of calibration base lines for this purpose. This publication was prepared in conjunction with this program and is directed to the land surveyor who uses EDMI. General observing procedures are outlined, and an analysis of the observations is developed. Detailed formulas are given for determining the geometric transformation of distances. An analysis is made of error sources affecting the ambient refractive index. GRA

N78-27513# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics.
ESTIMATING THE ECONOMIC VALUE OF NATURAL COASTAL WETLANDS: A COUNTRY NOTE
Leonard A. Shabman and Sandra S. Batie Aug. 1977 29 p refs
(Grants NOAA-04-6-158-44086; NOAA-04-7-158-44086)
(PB-279878/3; AE-30; UPI-SG-77-06; NOAA-78032003) Avail: NTIS HC A03/MF A01 CSCL 05C

The methodology used in the monetary evaluation of the nonmarket ecological services of wetlands is described. The major conceptual errors in the methodology and the value of the estimates of the economic value of marshland are defined. GRA

N78-27514# Mathews (A. A.), Inc., Arcadia, Calif. Mining Div.
CAPITAL AND OPERATING COST ESTIMATING SYSTEM METALLIC AND NONMETALLIC MINERALS EXCEPT FOSSIL FUELS IN THE UNITED STATES AND CANADA Final Report.
George K. Clement, Jr., Louis Avery, and Philip A. Seibert Oct. 1977 369 p
(Contract J-0255026)
(PB-277348/9; AAMI-1953-03; BM-OFR-10-78) Avail: NTIS HC A16/MF A01 CSCL 08I

Equations, factors, and curves for preparation of feasibility type estimates for capital and operating cost of mining and primary benefication in the United States and Canada of various types of minerals occurrences, except fossil fuels, using state-of-the-art technology are presented. User should have basic estimating experience in the mining industry and/or related fields. Primary usage of this handbook for the preparation of a preliminary estimate within a reasonable degree of accuracy with relative small amounts of hard input data are presented. Output is used to determine if a more finite type of estimate should be produced. GRA

N78-27465*# Texas Univ. at Austin. Dept. of Geological Sciences.
THE SPOKANE FLOOD CONTROVERSY
Victor R. Baker *In its* The Channeled Scabland 1978 p 3-15 refs (For primary document see N78-27464 18-42)
Avail: NTIS HC A09/MF A01 CSCL 08H

N78-27468*# Texas Univ. at Austin. Dept. of Geological Sciences.
PALEOHYDRAULICS AND HYDRODYNAMICS OF SCABLAND FLOODS
Victor R. Baker *In its* The Channeled Scabland 1978 p 59-79 refs (For primary document see N78-27464 18-42)
Avail: NTIS HC A09/MF A01 CSCL 08H

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N78-27515* National Aeronautics and Space Administration. Pasadena Office, Calif.
HEXAGON SOLAR POWER PANEL Patent
Irwin Rubin, inventor (to NASA) Issued 16 May 1978 5 p Filed 28 Jul. 1976
(NASA-Case-NPO-12148-1; US-Patent-4,089,705; US-Patent-Appl-SN-709415; US-Patent-Class-136-89P) Avail: US Patent Office CSCL 10A

A solar energy panel support is described upon which silicon cells are arrayed. The cells are wafer thin and of two geometrical types, both of the same area and electrical rating, namely hexagon cells and hourglass cells. The hourglass cells are composites of half hexagons. A near perfect nesting relationship of the cells achieves a high density packing whereby optimum energy production per panel area is achieved.
Official Gazette of the U.S. Patent Office

N78-27516 Case Western Reserve Univ., Cleveland, Ohio.
A DYNAMIC ENERGY OPTIMIZATION MODEL UNDER UNCERTAINTY Ph.D. Thesis
Reuven Robert Lenary 1978 165 p
Avail: Univ. Microfilms Order No. 78-09292

The problem is formulated and solved using a multi-period linear programming model. The model takes into consideration the variability of weather conditions and its effect on the demand for natural gas. Forecasts of future weather conditions are updated several times during the model planning period; also, the optimal

flows of natural gas are determined at the time that the forecasts are updated. The model considers alternatives such as: conservation of natural gas, emergency purchase of gas and gasifying coal to minimize shortages of natural gas. The optimal storage quantities at the beginning of each time period and the consequences of contracting additional storage facilities on the total natural gas shortage are derived by using the model.
Dissert. Abstr.

N78-27517 Princeton Univ., N. J.
DYNAMIC MODELS OF HOUSE HEATING BASED ON EQUIVALENT THERMAL PARAMETERS Ph.D. Thesis
Robert Carl Sonderegger 1978 238 p
Avail: Univ. Microfilms Order No. 7807500

The house is represented by a single electrical analog, composed of one capacitor and a few resistors, tied together in well determined fashion. The parameters of this model are fitted to recorded time histories of weather and heating load or indoor temperature of the house. The resulting Equivalent Thermal Parameters (ETP's) express a set of unique physical characteristics of the house: an equivalent thermal mass, a set of equivalent conductances (between indoors and outdoors, between indoors and the ground and between indoor room air and massive house structure) and overall efficiencies of furnace and solar heating. The ETP's can be used to establish energy performance standards for a house, useful in comparing houses with different construction. In fact, little knowledge about the house construction is needed to determine the ETP's. Another use for ETP's is the assessment of the overall effect of retrofits on a particular house, by observing the change in ETP's measured before and after the retrofit is implemented. Dissert. Abstr.

N78-27518*# Elcam, Inc., Santa Barbara, Calif.
PRELIMINARY DESIGN PACKAGE FOR SUNSPOT DOMESTIC HOT WATER HEATING SYSTEM
Nov. 1978 116 p Prepared for DOE
(Contract NAS8-32245)
(NASA-CR-150605) Avail: NTIS HC A06/MF A01 CSCL 10A

The design review includes a drawing list, auto-control logic, measurement definitions, and other document pertaining to the solar heated prototype hot water systems and two heat exchangers. The hot water systems consist of the following subsystems: collector, storage, control transport, auxiliary energy, and site data acquisition. Author

N78-27519*# AiResearch Mfg. Co., Torrance, Calif.
PRELIMINARY DESIGN PACKAGE FOR SOLAR HEATING AND COOLING SYSTEMS
May 1978 201 p Prepared for DOE
(Contract NAS8-32091)
(NASA-CR-150674; AiResearch-76-13448) Avail: NTIS HC A10/MF A01 CSCL 10A

Summarized preliminary design information on activities associated with the development, delivery and support of solar heating and cooling systems is given. These systems are for single family dwellings and commercial applications. The heating/cooling system use a reversible vapor compression heat pump that is driven in the cooling mode by a Rankine power loop, and in the heating mode by a variable speed electric motor. The heating/cooling systems differ from the heating-only systems in the arrangement of the heat pump subsystem and the addition of a cooling tower to provide the heat sink for cooling mode operation. L.S.

N78-27520*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SELF-RECONFIGURING SOLAR CELL SYSTEM Patent Application
Robert P. Gruber, inventor (to NASA) Filed 19 Jun. 1978 18 p
(NASA-Case-LEW-12586-1;,US-Patent-Appl-SN-916655) Avail: NTIS HC A02/MF A01 CSCL 10A

An improved solar cell system is reported that utilizes control circuits to switch some of its cells so that they can be either in series or in shunt within the array to match the load for maximum power transfer. Automatic control is provided by a sensor solar cell mounted into the configurable array; its open circuit voltage multiplied by a constant is equal to cell voltage at maximum power point. NASA

N78-27521*# National Aeronautics and Space Administration. Pasadena Office, Calif.
A TRANSPARENT PHOTOVOLTAIC MODULE Patent Application
Dan R. Lott (Lockheed Missile and Space Co., Sunnyvale, Calif.), Paul A. Dillard (Lockheed Missile and Space Co., Sunnyvale, Calif.), Walter M. Fritz (Lockheed Missile and Space Co., Sunnyvale, Calif.), and Gene J. Antonides, inventors (to NASA) (Lockheed Missile and Space Co., Sunnyvale, Calif.) Filed 26 Jun. 1978 13 p
(Contract JPL-954653)
(NASA-Case-NPO-14304-1; US-Patent-Appl-SN-918867) Avail: NTIS HC A02/MF A01 CSCL 10A

The invention relates to a photovoltaic module and more particularly to a photovoltaic module adapted to accommodate passage of solar radiation, whereby substantially all energy not used by the cells to produce electricity exits the module. The module includes a planar support panel formed of glass highly pervious to solar radiation, a plurality of contiguously related solar cells of substantially circular configurations, each cell of the plurality being characterized by a silicon wafer having a surface layer defining a P-N junction near one face of the cell, a transparent adhesive bonding each cell of the array to the support panel, a plurality of electrical interconnects connecting the cells in series, and electrical leads for connecting the module in an electrical circuit. NASA

N78-27522*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROCEEDINGS OF THE ALTERNATE ENERGY SYSTEMS SEMINAR
30 Mar. 1978 184 p Seminar held at Pasadena, Calif., 30 Mar. 1978; sponsored by DOE Sponsored in part by DOE
(Contract NAS7-100)
(NASA-CR-157255; JPL-Pub-78-45) Avail: NTIS HC A09/MF A01 CSCL 10A

The Alternative Energy Systems Seminar was held on March 30, 1978, and was sponsored jointly be the Southwest District Office of the U.S. Department of Energy and JPL. The seminar was an experiment in information exchange with the aim of presenting, in a single day, status and prospects for a number of advanced energy systems to a diverse, largely nontechnical audience, and to solicit post-seminar responses from that audience as to the seminar's usefulness. The major systems presented are: (1) Solar Photovoltaic; (2) Geothermal; (3) Cogeneration Power; (4) Solar Thermal; (5) Solar Heating and Cooling; (6) Wind Energy; and (7) Systems Considerations. For individual titles, see N78-27523 through N78-27529.

N78-27523*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLAR PHOTOVOLTAIC SYSTEMS
R. G. Forney *In its* Proc. of the Alternate Energy Systems Seminar 30 Mar. 1978 p 5-42 (For primary document see N78-27522 18-44)
Avail: NTIS HC A09/MF A01 CSCL 10A

The Department of Energy's photovoltaic program is outlined. The main objective of the program is the development of low cost reliable terrestrial photovoltaic systems. A second objective is to foster widespread use of the system in residential, industrial and commercial application. The system is reviewed by examining each component; silicon solar cell, silicon solar cell modules, advanced development modules and power systems. Cost and applications of the system are discussed. G.Y.

N78-27524*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GEOTHERMAL SYSTEMS
Casey Mohl *In its* Proc. of the Alternate Energy Systems Seminar 30 Mar. 1978 p 43-67 (For primary document see N78-27522 18-44)
Avail: NTIS HC A09/MF A01 CSCL 10A

Several tasks of JPL related to geothermal energy are discussed. The major task is the procurement and test and evaluation of a helical screw drive (wellhead unit). A general review of geothermal energy systems is given. The presentation focuses attention on geothermal reservoirs in California, with graphs and charts to support the discussion. Included are

discussions on cost analysis, systems maintenance, and a comparison of geothermal and conventional heating and cooling systems. G.Y.

N78-27525*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COGENERATION POWER SYSTEMS
Herbert S. Davis *In its* Proc. of the Alternate Energy Systems Seminar 30 Mar. 1978 p 68-96 (For primary document see N78-27522 18-44)
Avail: NTIS HC A09/MF A01 CSCL 10A

Cogeneration is defined as the combination of electrical generation and process heat for more efficient use of fuel. Comparisons of energy utilization in conventional electric power plants and cogeneration electric power plants are presented. Characteristics of various cogeneration systems are also presented. Systems are analyzed for use in utility systems and industrial systems. Economic and cost analysis are reviewed. G.Y.

N78-27526*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLAR THERMAL SYSTEMS
Vince C. Truscello *In its* Proc. of the Alternate Energy Systems Seminar 30 Mar. 1978 p 97-125 (For primary document see N78-27522 18-44)
Avail: NTIS HC A09/MF A01 CSCL 10A

A system is described for producing electricity with the use of conventional machinery, but with the elimination of conventional fuels, through the use of sun energy. The economics of the system is presented by comparing solar thermal units with more conventional systems. Several applications of the solar thermal system are presented. G.Y.

N78-27527*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLAR HEATING AND COOLING
R. E. Bartera *In its* Proc. of the Alternate Energy Systems Seminar 30 Mar. 1978 p 126-149 (For primary document see N78-27522 18-44)
Avail: NTIS HC A09/MF A01 CSCL 10A

To emphasize energy conservation and low cost energy, the systems of solar heating and cooling are analyzed and compared with fossil fuel systems. The application of solar heating and cooling systems for industrial and domestic use are discussed. Topics of discussion include: solar collectors; space heating; pools and spas; domestic hot water; industrial heat less than 200 F; space cooling; industrial steam; and initial systems cost. A question and answer period is generated which closes out the discussion. G.Y.

N78-27528*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
WIND ENERGY SYSTEMS
Homer Joe Stewart *In its* Proc. of the Alternate Energy Systems Seminar 30 Mar. 1978 p 150-170 (For primary document see N78-27522 18-44)
Avail: NTIS HC A09/MF A01 CSCL 10A

A discussion on wind energy systems involved with the DOE wind energy program is presented. Some of the problems associated with wind energy systems are discussed. The cost, efficiency, and structural design of wind energy systems are analyzed. G.Y.

N78-27529*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SYSTEM CONSIDERATIONS
M. E. Alper *In its* Proc. of the Alternate Energy Systems Seminar 30 Mar. 1978 p 171-177 (For primary document see N78-27522 18-44)
Avail: NTIS HC A09/MF A01 CSCL 10A

Closing remarks and a general summary of the Alternative Energy Systems Seminar are presented. It was concluded from the seminar that the DOE programs described were focused on trying to make a commercial market develop for the various systems. The question addressed is how this is going to happen. To address this question, social, economical, political and technical aspects are considered with major emphasis placed on systems engineering to provide low cost efficient systems. G.Y.

N78-27530*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HIGH-POWER, ULTRALOW-MASS SOLAR ARRAYS: FY-77 SOLAR ARRAYS TECHNOLOGY READINESS ASSESSMENT REPORT, VOLUME 1
E. N. Costogue, L. E. Young (NASA. Marshall Space Flight Center), and H. Brandhorst (NASA. Lewis Res. Center) 15 Jun. 1978 152 p 2 Vol.
(Contract NAS7-100)
(NASA-CR-157264; JPL-Pub-78-48-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 10A

The technology readiness of solar array designs for future planetary missions, and particularly for the Halley's comet ion drive space vehicle, is assessed. The effort involves critical component technology for the development of candidate solar array designs, and technology development planning. Results and conclusions are presented in summary form. G.G.

N78-27531*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HIGH-POWER, ULTRALOW-MASS SOLAR ARRAYS: FY-77 SOLAR ARRAYS TECHNOLOGY READINESS ASSESSMENT REPORT, VOLUME 2
E. N. Costogue, L. E. Young (NASA. Marshall Space Flight Center), and H. Brandhorst (NASA. Lewis Res. Center) 15 Jun. 1978 514 p refs 2 Vol.
(Contract NAS7-100)
(NASA-CR-157265; JPL-Pub-78-48-Vol-2) Avail: NTIS HC A23/MF A01 CSCL 10A

Development efforts are reported in detail for: (1) a lightweight solar array system for solar electric propulsion; (2) a high efficiency thin silicon solar cell; (3) conceptual design of 200 W/kg solar arrays; (4) fluorocarbon encapsulation for silicon solar cell array; and (5) technology assessment of concentrator solar arrays. G.G.

N78-27532*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
UTILIZATION OF WASTE HEAT IN TRUCKS FOR INCREASED FUEL ECONOMY
C. J. Leising, G. P. Purohit, S. P. DeGrey, and J. G. Finegold 1 May 1978 41 p refs Prepared for DoE
(Contract NAS7-100)
(NASA-CR-157292; JPL-Pub-78-39) Avail: NTIS HC A03/MF A01 CSCL 10A

Improvements in fuel economy for a broad spectrum of truck engines and waste heat utilization concepts are evaluated and compared. The engines considered are the diesel, spark ignition, gas turbine, and Stirling. The waste heat utilization concepts include preheating, regeneration, turbocharging, turbocompounding, and Rankine engine compounding. Predictions were based on fuel-air cycle analyses, computer simulation, and engine test data. The results reveal that diesel driving cycle performance can be increased by 20% through increased turbocharging, turbocompounding, and Rankine engine compounding. The Rankine engine compounding provides about three times as much improvement as turbocompounding but also costs about three times as much. Performance for either is approximately doubled if applied to an adiabatic diesel. Author

N78-27533*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A MARKET SURVEY OF GEOTHERMAL WELLHEAD POWER GENERATION SYSTEMS Final Report
Michael W. Leeds Mar. 1978 53 p refs
(Contracts NAS7-100; EG-77-A-36-1021)
(NASA-CR-157262; JPL-Pub-78-29) Avail: NTIS HC A04/MF A01 CSCL 10A

The market potential for a portable geothermal wellhead power conversion device is assessed. Major study objectives included identifying the most promising applications for such a system, the potential impediments confronting their industrialization, and the various government actions needed to overcome these impediments. The heart of the study was a series of structured interviews with key decision-making individual in the various disciplines of the geothermal community. In addition, some technical and economic analyses of a candidate system were performed to support the feasibility of the basic concept. L.S.

N78-27534*# Fern Engineering Co., Buzzards Bay, Mass.
PRELIMINARY DESIGN PACKAGE FOR SOLAR HEATING AND HOT WATER SYSTEM
Jan. 1977 133 p Prepared for DoE
(Contract NAS8-32246)
(NASA-CR-150613) Avail: NTIS HC A07/MF A01 CSCL 10A

The preliminary design review on the development of two prototype solar heating and hot water systems is presented. The information contained in this report includes system certification, system functional description, system configuration, system specification, system performance and other documents pertaining to the progress and the design of the system. This system, which is intended for use in the normal single-family residence, consists of the following subsystems: collector, storage, control, transport, and Government-furnished Site Data Acquisition. L.S.

N78-27535*# Houston Chemical Co., Corpus Christi, Tex.
SOLAR HEAT TRANSPORT FLUID Quarterly Report, Feb. 1978 - May 1978
Jun. 1978 13 p Prepared for DoE
(Contract NAS8-32255)
(NASA-CR-150704) Avail: NTIS HC A02/MF A01 CSCL 10A

The progress made in the development and delivery of noncorrosive fluid subsystems is discussed. These subsystems are to be compatible with closed-loop solar heating or combined heating and hot water systems. They are also to be compatible with both metallic and non-metallic plumbing systems. The performance testing of a number of fluids is described. L.S.

N78-27536*# Wormser Scientific Corp., Stamford, Conn.
PRELIMINARY DESIGN PACKAGE FOR SOLAR HEATING AND HOT WATER SYSTEM
Jan. 1977 56 p Prepared for DoE
(Contract NAS8-32250)
(NASA-CR-150616) Avail: NTIS HC A04/MF A01 CSCL 10A

The preliminary design review on the development of a multi-family solar heating and domestic hot water prototype system is presented. The report contains the necessary information to evaluate the system. The system consists of the following subsystems: collector, storage, transport, control and Government-furnished site data acquisition. L.S.

N78-27537*# AiResearch Mfg. Co., Torrance, Calif.
PRELIMINARY DESIGN ACTIVITIES FOR SOLAR HEATING AND COOLING SYSTEMS Status Report, 12 Jul. - 1 Sep. 1976
May 1978 222 p refs Prepared for DoE
(Contract NAS8-32091)
(NASA-CR-150673; AiResearch-76-12994) Avail: NTIS HC A10/MF A01 CSCL 10A

Information on the development of solar heating and cooling systems is presented. The major emphasis is placed on program organization, system size definition, site identification, system approaches, heat pump and equipment design, collector procurement, and other preliminary design activities. B.B.

N78-27538*# Little (Arthur D.), Inc., Cambridge, Mass.
EVALUATION OF SOLAR CELLS AND ARRAYS FOR POTENTIAL SOLAR POWER SATELLITE APPLICATIONS Final Report
David W. Almgren, Katinka Csigi, and Arthur D. Gaudet 31 Mar. 1978 81 p
(Contract NAS9-15294)
(NASA-CR-151740) Avail: NTIS HC A05/MF A01 CSCL 10A

Proposed solar array designs and manufacturing methods are evaluated to identify options which show the greatest promise of leading up to the develpment of a cost-effective SPS solar cell array design. The key program elements which have to be accomplished as part of an SPS solar cell array development program are defined. The issues focussed on are: (1) definition of one or more designs of a candidate SPS solar array module, using results from current system studies; (2) development of the necessary manufacturing requirements for the candidate SPS solar cell arrays and an assessment of the market size, timing, and industry infrastructure needed to produce the arrays for the SPS program; (3) evaluation of current DOE, NASA and DOD photovoltaic programs to determine the impacts of recent advances in solar cell materials, array designs and manufacturing technology on the candidate SPS solar cell arrays; and (4) definition of key program elements for the development of the most promising solar cell arrays for the SPS program. L.S.

N78-27539*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COST OF PHOTOVOLTAIC ENERGY SYSTEMS AS DETERMINED BY BALANCE-OF-SYSTEM COSTS
Louis Rosenblum Jun. 1978 14 p refs
(NASA-TM-78957; E-9708) Avail: NTIS HC A02/MF A01 CSCL 10B

The effect of the balance-of-system (BOS), i.e., the total system less the modules, on photo-voltaic energy system costs is discussed for multikilowatt, flat-plate systems. Present BOS costs are in the range of 10 to 16 dollars per peak watt (1978 dollars). BOS costs represent approximately 50% of total system cost. The possibility of future BOS cost reduction is examined. It is concluded that, given the nature of BOS costs and the lack of comprehensive national effort focussed on cost reduction, it is unlikely that BOS costs will decline greatly in the next several years. This prognosis is contrasted with the expectations of the Department of Energy National Photovoltaic Program goals and pending legislation in the Congress which require a BOS cost reduction of an order of magnitude or more by the mid-1980s. Author

N78-27540*# [illegible]nternational Corp., Lewistown, Pa.
EVALUATION OF GLASS RESIN COATINGS FOR SOLAR CELL APPLICATIONS Final Report
M. B. Field Apr. 1978 38 p
(Contract NAS3-20958)
(NASA-CR-159392) Avail: NTIS HC A03/MF A01 CSCL 10A

Using a variety of non-vacuum deposition techniques coatings were implemented on silicon solar cells and arrays of cells interconnected on Kapton substrates. The coatings provide both antireflection optical matching and environmental protection. Reflectance minima near 2% was achieved at a single wavelength in the visible. Reflectance averaging below 5% across the useful collection range was demonstrated. The coatings and methods of deposition were: (1) Ta2O5 spun, dipped or sprayed; (2) Ta2O5.SiO2 spun, dipped or sprayed; (3) GR908 (SiO2) spun, dipped, or sprayed. Total coating thickness were in the range of 18 microns to 25 microns. The coatings and processes are compatible with single cells or cells mounted on Kapton substrates. G.Y.

N78-27541*# National Aeronautics and Space Administration. Pasadena Office, Calif.
AN IMPROVED SOLAR CELL AND METHOD OF FORMING THE SAME Patent Application
Kenneth R. Bube, inventor (to NASA) (RCA Corp., Moorestown, New Jersey) Filed 30 Jun. 1978 8 p
(Contract NAS7-100)
(NASA-Case-NPO-14205-1; US-Patent-Appl-SN-920879) Avail: NTIS HC A02/MF A01 CSCL 10A

An improved solar cell, and a method of forming the same is characterized by a semiconductor silicon wafer to P-type material having diffused therein a shallow N-type region, a sintered silver contact affixed to the surface of the N-type region. It is formulated from silver powder blended with silver metaphosphate for establishing beneath the contact a zone of increased carrier concentration, and an aluminum or silver/aluminum alloy contact affixed to the wafer at the outer surface thereof opposite the N-type region. The instant invention provides an improved solar cell characterized by an improved contact affixed to the N-type region thereof which serves to establish a zone of increased carrier concentration, without excessive metallization penetration whereby conductivity is enhanced without sacrificing efficiency. NASA

N78-27542# Little (Arthur D.), Inc., Cambridge, Mass.
DESIGN, DEVELOPMENT, AND DEMONSTRATION OF A PROMISING INTEGRATED APPLIANCE. PHASE 1: DESIGN Final Report
W. David Lee, W. Thompson Lawrence, and Robert P. Wilson Sep. 1977 255 p refs
(Contract EY-76-C-03-1209)
(SAN/1209-1) Avail: NTIS HC A12/MF A01

The results of the work performed to identify the most promising integrated appliance candidates and to recommend a demonstration program most likely to accelerate the commercialization of the integrated appliances are reported. The key tasks of the program are: (1) to obtain background information and data on conventional appliances; (2) develop criteria for identifying and evaluating potential integrated appliance candidates; (3) identify and evaluate candidates according to the criteria developed in the previous task; (4) to develop a demonstration plan for the most promising candidates; and (5) prepare a final report covering all work. G.Y.

N78-27543# Durham Urban Observatory, N. C.
BUILDING ENERGY CONSERVATION STUDY FOR THE CITY OF DURHAM, NORTH CAROLINA Final Report
Ish Sud, Robert W. Wiggins, Jr., and Jack B. Chaddock Jan. 1978 102 p
(Contract HUD-H-2196R)
(PB-278721/6; UO-LCCM-DUR-78-017) Avail: NTIS HC A06/MF A01 CSCL 10A

The City of Durham, North Carolina as a major utility customer and energy consumer worked with the Duke University Center for the study of energy conservation to research the energy saving potential of its major buildings. Energy audits were performed on the savings potential of its major buildings. Energy audits were performed on eleven structures in the Department of Public Safety and on three recreation centers. A computerized analysis was performed on the new City Hall Building, occupied in May, 1977, using the AXCESS program of the Edison Electric Institute. The research produced potential annual energy savings of $27,375 with an average modification payback of .8 years. GRA

N78-27544# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
RESEARCH TOWARD IMPROVED FLYWHEEL SUSPENSION AND ENERGY CONVERSION SYSTEMS Final Report
David Eisenhaure Nov. 1977 181 p refs
(Grant NSF AER-75-18813)
(PB-278679/G; R-1108) Avail: NTIS HC A09/MF A01 CSCL 10B

Flywheel and energy conversion studies were directed toward the utilization of flywheel energy storage for utility load-leveling during peak power periods, both at the residential and utility levels, for complementing windmill or photovoltaic systems, and for transportation systems. A set of system requirements which would allow two-way power flow between a high speed flywheel shaft and a 60 Hz line was outlined. Existing conversion system types were studied, indicating that the system requirements could be best met with a new concept. Therefore, a special purpose integrated rotating machine and power switching stage were designed. GRA

N78-27545# Washington Univ., Seattle. Dept. of Mining Metallurgical, and Ceramic Engineering.
FEASIBILITY STUDY OF MINING ALASKA COAL AND TRANSPORTATION BY SLURRY TO THE WEST COAST Final Report
Donald Anderson 5 Jan. 1978 37 p
(Contract DI-BM-GO-264012)
(PB-278755/4; BM-OFR-17(1)-78) Avail: NTIS HC A03/MF A01 CSCL 08I

The extensive subbituminous coal deposits near Cook Inlet, Alaska, have received considerable attention because of their size, nearness to tidewater, and low sulfur content. As the need for increased electrical power is felt along the west coast, a search is being made for sources of fuel other than petroleum and natural gas. The State of Washington is the only Pacific Coast State with substantial coal resources, but because of geologic setting, much of this resource will be available only at high cost. Reflecting these circumstances, if coal is to be used as a source of electrical energy, it may have to be transported from the Northern Great Plains or Rocky Mountain areas or from more remote sites if they happen to be located at or near tidewater GRA

N78-27546# Army Mobility Equipment Command, Fort Belvoir, Va.
SOLAR CELL POWER FOR FIELD INSTRUMENTATION AT WHITE SANDS MISSILE RANGE Final Report
John Bond, Darwin H. Reckart, Jr., and William B. Milway Jan. 1978 56 p
(AD-A053960; MERADCOM-2229) Avail: NTIS HC A04/MF A01 CSCL 10/2

The initial phase of an Instrumentation Development Project to explore and document what solar power can do for remote field instrumentation systems is described. The work scope consisted of selection, design, construction, test, and delivery of a solar cell power system for White Sands Missile Range. A Drone Formation Control System Interrogator was selected; a power supply was built and installed in the San Andres Mountain Range at WSMR in late August 1977. Author (GRA)

N78-27547# Gould, Inc., Rolling Meadows, Ill. Gould Labs.
STATE-OF-THE-ART LEAD-ACID VEHICLE
26 Aug. 1977 64 p
(Contract W-31-109-eng-38)
(ANL-K-77-3639-1) Avail: NTIS HC A04/MF A01

A report is given of the state of the art of electric vehicle batteries, what the technology is capable of mass-producing within two years, and what are the research and development tasks that must be undertaken to achieve goals for both the improved state-of-the-art battery and the advanced battery. Energy intensive and life intensive candidate design for electric-vehicle lead-acid batteries are discussed and performance projections are tabulated. ERA

N78-27548# Little (Arthur D.), Inc., Cambridge, Mass.
SYSTEM DEFINITION STUDY: PHASE 1 OF INDIVIDUAL LOAD CENTER, SOLAR HEATING AND COOLING RESIDENTIAL PROJECT Final Report
James C. Burke, Richard L. Merriam, and John L. Swanson Dec. 1977 275 p refs Sponsored by Elec. Power Res. Inst.
(EPRI Proj. 549-1)
(EPRI-ER-594) Avail: NTIS HC A12/MF A01

A study was carried out to determine preferred systems for residential solar and load management heating, cooling and domestic hot water systems in the Northeast and Southwest regions of the United States. A methodology relating the performance of solar and load management heating and cooling systems to utility power generation, costs of supply and weather characteristics was developed. Preferred systems in the service areas of two utilities were identified. Preliminary designs for five experimental systems in both service areas were developed with the intent of maximizing the acquisition of experimental information on systems compatible with utility operations. The methodology provides a means of determining systems which, on a life cycle cost basis, minimize the total cost of meeting the energy needs for a specific application including investments in generating capacity at the power plant, fuel costs and investments at the point of use for energy conservation. The methodology was tested for 14 additional utilities throughout the United States. ERA

N78-27549# Exxon Research and Engineering Co., Florham Park, N. J.
EDS COAL LIQUEFACTION PROCESS DEVELOPMENT, PHASE 3 B Monthly Technical Progress Report, 1-31 Dec. 1977
Jan. 1978 56 p refs Sponsored in part by the Carter Oil Co., Elec. Power Res. Inst. and Phillips Petrol. Co.
(Contract EF-77-A-01-2893)
(FE-2893-6) Avail: NTIS HC A04/MF A01

The sovent quality study with Wyoming subbituminous coal in the 50 pound-per-day Recycle Coal Liquefaction Unit was completed. The study concentrated on investigation of the effects of increased solvent-to-coal ratio and liquefaction residence time. The liquefaction yield structure used for the updated commercial study design was finalized based on the latest runs at the coal liquefaction pilot plant. Earlier results, which indicated higher start-of-run temperatures were required for a heavier feedstock to reach the same solvent donatable hydrogen level as for Multi-Pass Spend Solvent (MPSS), were confirmed. A process variable screening study utilizing Ni/Mo-10 and Ci/Mo-20 catalysts and Wyoming spent solvent was completed on the solvent hydrogenation two-train catalyst testing unit. The variables

investigated were start-of-run temperatures and space velocities. ERA

N78-27550# Booz-Allen and Hamilton, Inc., Bethesda, Md. Applied Research Div.
PROJECT ACQUISITION AND EVALUATION PROCESS FOR ATMOSPHERIC FLUIDIZED BED COMBUSTION DEMONSTRATION PLANT
30 Sep. 1977 279 p
(Contract EX-76-C-01-2345)
(FE-2343-1) Avail: NTIS HC A13/MF A01

Fluidized bed technology provided a method of burning coal of all ranks (including high sulfur, high ash, agglomerating, and caking coal) and meeting environmental standards without pretreatment or scrubbing. FBC will hava its greatest potential in utilizing pressurized reactors with combined cycle turbine systems but the FBC technology closest to commercial readiness is atmospheric fluidized bed combustion (AFBC) combined with traditional Rankine steam cycles. The current state of the AFBC development program is that numerous bench-scale and process development units are completed or underway; a 30 MWe pilot plant is in the startup and shakedown stage; a component test and integration unit is in the early construction stage; and conceptual designs are being performed for demonstration plants. ERA

N78-27551# General Atomic Co., San Diego, Calif.
GENERAL ATOMIC, LOS ALAMOS SCIENTIFIC LABORATORY, DEPARTMENT OF ENERGY, INTERFACE DOCUMENT FOR THE MB-75 mW (B) PROGRAM INITIAL DRAFT
N. B. Elsner Nov. 1977 8 p
(Contract EY-76-C-03-0167-060; Proj. 3246)
(GA-A-14719) Avail: NTIS HC A02/MF A01

The five 75 mW radioisotope thermoelectric generators (RTGs) will be fabricated and delivered. The generators will initially be qualified as electrically heated thermoelectric generators at GA. This qualification will consist of short term life testing as well as acceptance shock and vibration testing. The generators will be shipped to LASL where they will be fueled with heat sources supplied by Mound. The final assembly and check out will be performed at LASL with both LASL and GA personnel. The RTGs will be delivered to the DOE at LASL. ERA

N78-27552*# Thermo Electron Engineering Corp., Waltham, Mass.
ERDA/NASA ADVANCED THERMIONIC TECHNOLOGY PROGRAM Progress Report
Sep. 1977 11 p
(Contracts NAS3-20959; EY-76-C-02-3056)
(NASA-CR-157248; TE4220/4233-44-78; COO-3056-29; PR-27) Avail: NTIS HC A02/MF A01

Research progress is briefly outlined in the areas of activation experiments, enchanced mode conversion experiments, converter development (tungsten emitter, lanthanum hexaborate collector), and hot shell development. Author (ERA)

N78-27553# United Technologies Corp., South Windsor, Conn.
ADVANCED TECHNOLOGY FUEL CELL PROGRAM Interim Report
J. M. King, Jr. Nov. 1977 78 p refs
(EPRI-EM-576) Avail: NTIS HC A05/MF A01

Molten carbonate fuel cells, advanced phosphoric acid fuel cells, advanced fuel processors and the use of coal and coal products in central stations or dispersed fuel cell powerplants are under investigation. Molten carbonate fuel cell activities focused on reactant containment, increased endurance, and improved performance. The effort is continuing to demonstrate cell performance and function for extended periods at the cell stack level. An advanced phosphoric acid cell concept, with potential for reduced cost and reduced resistance losses, was demonstrated in a 20-cell stack. The best performing cells achieved expectations, and the concept was successfully demonstrated. Investigations showed that adiabatic steam reforming holds promise for processing No. 2 fuel oil in dispersed fuel cell generators, and subscale testing was conducted to establish acceptable operating conditions. ERA

N78-27554# Auburn Univ., Ala. Inst. of Water Resources Research.
SUBSURFACE WASTE-HEAT STORAGE: EXPERIMENTAL STUDY Final Report, 15 Nov. 1975 - 30 Jun. 1977
James C. Warman, Fred J. Molz, and Thomas E. Jones Jun. 1977 67 p refs
(Contract EY-76-S-05-5003)
(ORO-5003-1) Avail: NTIS HC A04/MF A01

Electrical power plant and solar heating systems were proposed wherein confined aquifers are used as storage reservoirs for moderate to high temperature water. The Water Resources Research Institute of Auburn University performed an aquifer storage experiment involving warm water (94 F; 36 C). Phase I consisted of the drilling of an exploratory well at the field site near Mobile, Alabama. Phase II involved construction of the central injection well, three observation wells, and performance of preliminary pumping tests. Phase III was devoted to construction of the remainer of the observation well field, performance of final pumping tests, and measurement of aquifer thermal properties; while Phase IV was devoted to a cycle of warm water injection, storage, and recovery. It was concluded that heat storage aquifers must have low natural pore velocities, and much care must be taken not to clog the injection well with solids. ERA

N78-27555# Oak Ridge National Lab., Tenn.
POTASSIUM VAPOR TOPPING CYCLE Technical Progress Report, 1 Jul. - 30 Sep. 1977
R. S. Holcomb Feb. 1978 31 p refs
(Contract W-7405-eng-26)
(ORNL-TM-6153) Avail: NTIS HC A03/MF A01

The potassium vapor topping cycle is a concept for increasing the efficiency of the Rankine vapor cycle by raising the peak temperature by employing a potassium vapor cycle with a turbine inlet temperature of 1500 to 1600 F (815 to 870 C) in which the waste heat rejected from the condensing potassium vapor is transferred to boiling water and steam in a conventional steam cycle. An efficiency of about 50% is calculated for this cycle with a natural circulation potassium boiler fired by gas or oil. A DOE program is underway to build a full scale potassium boiler tube bundle and burner module and test it with water and then potassium. The potassium system installation was completed. The potassium piping installation was completed. The wiring was connected to the electric heaters and thermocouples, and the air preheater was installed. ERA

N78-27556# Institute of Gas Technology, Chicago, Ill.
MOLTEN-SALT THERMAL-ENERGY STORAGE SYSTEMS
J. F. Dullea and H. C. Maru 1977 12 p ref Presented at the 2d Ann. Thermal Energy Storage Contractors' Inform. Exchange Meeting, Gatlinburg, Tenn., 29 Sep. 1977
(Contract EY-76-C-02-2888)
(CONF-770955-3) Avail: NTIS HC A02/MF A01

The goals of the program are to determine the technical feasibility of using inorganic salts as phase-change thermal storage materials (PCM) for high-temperature (> 300 C applications, to develop a mathematical model able to predict the behavior of a PCM in a latent heat, thermal energy storage (TES) system, and to use this information in designing prototype, large scale (100 to 100 kWhr/sub t/) storage systems for further technical and economic evaluation. The first phase of the program, involving selection of a suitable storage material, matehamtical modeling, heat transfer analysis, and operation of small scale (< 10 kWhr/sub t/) TES systems, was completed. Results were encouraging, showing good agreement between the mathematical model and the observed performance. Further work on system analysis, performance improvements, and large scale system design is now in progress. ERA

N78-27557# Sandia Labs., Albuquerque, N. Mex.
THERMOCHEMICAL ENERGY STORAGE SYSTEMS: A REVIEW
R. W. Mar and T. T. Bramlette Feb. 1978 47 p refs
(Contract EY-76-C-04-0789)
(SAND-77-8051) Avail: NTIS HC A03/MF A01

The report reviews the characteristics of thermochemical storage systems, analyzes the present state-of-the-art of the

relevant technical disciplines, and presents some potential solar storage applications. ERA

N78-27558# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.
HYDROGEN-CHLORINE ENERGY STORAGE SYSTEM
J. McBreen, R. S. Yeo, A. Beaufrere, D. T. Chin, and S. Srinivasan 1977 9 p refs
(BNL-23670; Conf-771131-4) Avail: NTIS HC A02/MF A01

The electrochemically regenerative hydrogen-chlorine system is being considered for large scale energy storage. It offers many of the advantages of batteries with fluid reactants such asd elimination of the problem of electrode morphology changes with cycling and the possibility of independently designing the system for energy and power. Hence, it can be used for both the daily and weekend utility cycles. Recent work includes an extensive heat and mass balance analysis for the system, measurements of Nafion membrane resistivity as a function of HCl concentration and temperatures, and diffusivities and permeation rates of chlorine through Nafion membranes. Results of these studies indicate that an overall electric-to-electric efficiency of 75% or greater can be projected for the system. Author

N78-27559# California Univ., Davis. Dept. of Land, Air, and Water Resources.
ENERGY REQUIREMENTS OF ALTERNATIVES IN WATER SUPPLY, USE, AND CONSERVATION, AND WATER QUALITY CONTROL IN CALIFORNIA Final Report
Edwin B. Roberts and Robert M. Hagan Sep. 1977 150 p refs
(Contract W-7405-eng-48)
(UCRL-13784) Avail: NTIS HC A07/MF A01

Information is presented on: energy requirements associated with water supply and use and waste water treatment; form water supply sources and pumping energy requirements; total energy requirements for irrigation in 1972; and energy requirements associated with irrigation water quality problems in California. Author (ERA)

N78-27560# Department of Energy, Washington, D. C.
ANALYSIS OF THE CURRENT ECONOMIC FEASIBILITY OF SOLAR WATER AND SPACE HEATING
R. H. Bezdek Jan. 1978 43 p
(DOE/CS-0023) Avail: NTIS HC A03/MF A01

The current economic feasibility of solar water and space heating in four representative cities in the U.S. is analyzed. The four representative cities are Boston, Massachusetts; Washington, D.C.; Grand Junction, Colorado; and Los Angeles, California. The feasibility of solar water heating and combined water and space heating is examined separately for single family detached homes and for multi-family apartment buildings. Using actual 1977 regional fuel prices and solar equipment costs, the solar systems are competed against conventional gas, fuel oil, and electric systems. The results are evaluated on the basis of three decision criteria, an identical analysis is then carried out assuming the passage of a solar income tax credit. ERA

N78-27561# Sandia Labs., Albuquerque, N. Mex.
FACTORS AFFECTING MARKET INITIATION OF SOLAR TOTAL ENERGY
R. W. Harrigan 1978 6 p refs Presented at the Symp. on Energy, Tulsa, Okla., 16 Apr. 1978
(Contract EY-76-C-04-0789)
(SAND-78-0148C; Conf-780413-1) Avail: NTIS HC A02/MF A01

An economic methodology is introduced for quickly visualizing the effect of various economic, technical, and programmatic actions on the early commercialization of solar total energy (STE). Process-heat users are identified as primary candidates for earliest market initiation. In addition, while technical factors such as improved power-conversion efficiency and mirror reflectivity do affect time-of-market initiation, programmatic and economic factors such as government-induced mass production of solar collectors and investment tax credits have even greater influence on the market initiation of STE. ERA

N78-27562# Sandia Labs., Albuquerque, N. Mex.
MASTER CONTROL AND DATA SYSTEM FOR THE 5MW SOLAR THERMAL TEST FACILITY
D. M. Darsey 1978 8 p Presented at the 24th Intern. Instrumentation Symp., Albuquerque, N. Mex., 1 May 1978
(Contract EY-76-C-04-0789)
(SAND-78-0205C; Conf-780503-5) Avail: NTIS HC A02/MF A01

The world's largest solar powered research facility, approaching contruction completion near Albuquerque, New Mexico, is controlled by a distributed network of minicomputers. The philosophy of the system design and details the system control components, operation and data capabilities are described. ERA

N78-27563# Sandia Labs., Albuquerque, N. Mex.
REAL TIME COMPUTER CONTROL OF 5 MEGAWATTS OF SOLAR THERMAL ENERGY
E. D. Thalhammer 1978 7 p refs Presented at 24th Intern. Instrumentation Symp., Albuquerque, N. Mex., 1 May 1978
(Contract EY-76-C-04-0789)
(SAND-78-0204C; Conf-780503-6) Avail: NTIS HC A02/MF A01

The Solar Thermal Test Facility operates under the control of a nine machine distributed minicomputer network. The prime functions of this network are heliostat controls, heat rejection system controls, and data acquisition. The control computer is described. This computer's main tasks are: (1) the sun position calculation, (2) automatic heliostat command execution, (3) graphic display of heliostat status and selected items of tower and boiler control data, (4) operator control of the heliostat command cycle, (5) heliostat alarm handling, and (6) the permanent recording of all test parameters necessary to fully describe the experiment performed. The control system is capable of directing 5 megawatts of thermal energy at any point within 327 meters of the solar receiver tower. Also described are the procedures and checking performed by the computers to insure personnel and facility safety. ERA

N78-27564# Sandia Corp., Livermore, Calif.
BUCKS: ECONOMIC ANALYSIS MODEL OF SOLAR ELECTRIC POWER PLANTS
J. M. Brune Jan. 1978 54 p refs
(Contract EY-76-C-04-0789)
(SAND-77-8279) Avail: NTIS HC A04/MF A01

A computer model (BUCKS) is designed for economic analysis of solar electric power plants. The model determines the levelized life-cycle revenue per unit output from the plant that will be sufficient to compensate for the fixed and variable costs, pay interest to bondholders, and provide return to stockholders. Cost-scaling relationships for solar-plant subsystems have been developed that allow BUCKS in conjunction with a plant performance model to perform a number of cost/benefit calculations. ERA

N78-27565# California Univ., Berkeley. Sanitary Engineering Research Lab.
SOLAR ENERGY CONVERSION WITH HYDROGEN PRODUCING ALGAE Final Report, 1 Feb. 1976 - 31 Apr. 1977
J. R. Benemann, P. C. Hallenbeck, J. C. Weissman, L. V. Kochian, P. C. Kostel, and W. J. Oswald Jun. 1977 44 p refs
(Contract EY-76-S-03-0034-239)
(SAN/0034-77/1) Avail: NTIS HC A03/MF A01

Biophotolysis--the production of hydrogen and oxygen from water and sunlight by biological catalysts--was demonstrated, for the first time, using nitrogen-starved cultures of the blue-green alga Anabaena cylindrica. This system demonstrates all the requirements for development of a practical system of biophotolysis--high (23 microns moles/mg dry weight) and sustained (3 weeks or longer) hydrogen and oxygen production at a 2:1 ratio with no fundamental limitations in scale-up, stability, or longevity. Present limitations of this system may be classified as biochemical, physiological engineering. Advances were made in all areas. Operation of an outdoor biophotolysis system demonstrates the basic feasibility of this method of energy conversion. An engineering and economic analysis reveals many aspects of this system which will require further research and development before practical applications will be possible. ERA

N78-27566# Sandia Labs., Albuquerque, N. Mex.
SANDIA LABORATORIES' 1977 CONCENTRATOR SILICON

SOLAR CELL: DESIGN, FABRICATION, AND PERFORMANCE
J. G. Fossum and E. L. Burgess Feb. 1978 9 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0239) Avail: NTIS HC A02/MF A01

The 1977 version of Sandia Laboratories' concentrator silicon solar cell is described. The design, the fabrication, and the performance of the cell are specified. ERA

N78-27567# Stanford Univ., Calif.
SILICON PHOTOVOLTAIC CELLS IN TPV CONVERSION Interim Report
R. N. Bracewell and R. M. Swanson Feb. 1978 86 p refs
(EPRI-ER-633) Avail: NTIS HC A05/MF A01

The feasibility of a solar electric thermophotovoltaic system (TPV) was assessed. A numerical model of TPV conversion was developed both for the purpose of assessing TPV conversion and to facilitate an initial design of TPV photocells. Also, a facility for experimentally evaluating TPV photocells was designed and built. Three runs of TPV cells were fabricated and tested. These achieve efficiences of 7, 10, and 12% respectively. The cells have negligible resistance loss at currents up to 50 A/cm or 1000 suns. When proper electrical and geometrical parameters for the photovoltaic cell were assumed, the numerical model was found to describe correctly all aspects of the observed behavior of the TPV cells. The model predicts that reduction of parasitic absorption to levels considered achievable will yield TPV cell efficiencies in excess of 30%. ERA

N78-27568# Brookhaven National Lab., Upton, N. Y. Div. of Basic Energy Sciences.
METAL HYDRIDE DEVELOPMENT PROGRAM AT BROOKHAVEN NATIONAL LIBRARY
J. R. Johnson and J. J. Reilly 1977 10 p refs Presented at the DOE Ann. Chem. Energy Storage and Hydrogen Energy System Contract Rev., Baltimore, 16 Nov. 1977
(Contract EY-76-C-02-0016)
(BNL-23574; Conf-771131-2) Avail: NTIS HC A02/MF A01

A progress report which discusses some of the following subjects is presented: The influence of the free energy change and the metal atom mobility upon the reaction of intermetallic compounds with hydrogen; the properties of ferro-titanium alloy hydrides formulated for a specific application (H2-Cl2 dual model cell); the effect of cyclic hydriding and dehydriding on FeTi; and the TiCr2-H system and its properties. ERA

N78-27569# Sandia Labs., Albuquerque, N. Mex.
BRAKE SYSTEM FOR THE 17 METER VERTICAL AXIS WIND TURBINE
C. W. Dodd Feb. 1978 27 p
(Contract EY-76-C-04-0789)
(SAND-77-1331) Avail: NTIS HC A03/MF A01

The design philosophy and operating procedure of the hydraulic brake system on the 17-meter vertical axis wind turbine are described. Design details and a functional description of system components are included. ERA

N78-27570# Philips Labs., Briarcliff Manor, New York.
STIRLING TOTAL ENERGY SYSTEMS STUDY Final Report, 15 May 1976 - 13 Jun. 1977
D. Lehrfeld Aug. 1977 190 p refs Sponsored by DOE
(HCP/T2947-1) Avail: NTIS HC A09/MF A01

The application of Stirling cycle prime movers to total energy power generation systems was investigated. Electrical, heating, and cooling demand profiles for a typical residential complex, hospital, and office building were studied, and alternative Stirling total energy systems were conceptualized for each site. These were analyzed in detail and contrasted with purchased power systems for these sites to determine fuel energy savings and investment attractiveness. The residential complex and hospital would be excellent candidates for total energy systems, and prime movers in the 1000 kW output range would be required. Consideration was given to the following technological decision areas before arriving at a final design: engine configuration, hotside heat exchange interface, engine control system, internal gas seals, and advanced coal combustion technology. The principal advantage of a Stirling prime mover in this application, is that it could utilize low grade liquid fuels and coal. ERA

N78-27571# Institute of Gas Technology, Chicago, Ill.
INTERMEDIATE AND HIGH-TEMPERATURE FLUE GAS RECUPERATORS FOR A VARIETY OF INDUSTRIAL PROCESS ENVIRONMENTS Summary Status Report, 1 Aug. - 31 Oct. 1977
C. J. Marnell and T. Gawlowski Nov. 1977 8 p
(Contract EC-77-C-02-4235)
(COO-4235-2) Avail: NTIS HC A02/MF A01

Preliminary layouts and engineering of a stack type recuperator were completed and approved. Preliminary control systems design were completed and approved. Detailed drawings of major systems were initiated. Specifications for the combustion air system, the recuperator, and the furnace control systems were completed, and procurement of equipment is proceeding. ERA

N78-27572# Resources for the Future, Inc., Washington, D. C.
HOW INDUSTRIAL SOCIETIES USE ENERGY
J. Darmstadter, J. Dunkerley, and J. Alterman Feb. 1978 39 p refs Sponsored by EPRI
(EPRI Proj. 384)
(EPRI-EA-707-SY) Avail: NTIS HC A03/MF A01

An attempt is made to find an answer as to why the per capita consumption of primary energy resources are so much higher in the U.S. than in other industrial countries, whose per capita income does not differ appreciably from that of the U.S. Comparative patterns of energy consumption are considered for the U.S., Canada, France, West Germany, Italy, Netherland, UK, Sweden, and Japan. Those components that give rise to variations between countries in the relationship between energy use and national output are identified. As far as possible, the respective contributions of (1) economic structure, and (2) characteristics of energy utilization to the intercountry variations in energy and output are interpreted. Where the data permit, underlying factors--such as relative price differences and demographic features--are woven into the analysis. ERA

N78-27573# Department of Energy, Washington, D. C.
METHODS OF FORECASTING OF SCIENTIFIC AND TECHNICAL PROGRESS IN THE PRODUCTION AND CONSUMPTION OF FUEL AND ENERGY RESOURCES
S. N. Yatrov 1977 47 p refs Transl. into ENGLISH from report from the All-Union Scientific Research Inst. of Complex Fuel and Energy Problems, State Planning Committee of the USSR (Moscow), 1977 47 p
(DOE-tr-24) Avail: NTIS HC A03/MF A01

The following subjects are discussed: systems and indices for forecasting the scientific and technical progress in the production and consumption of technical and economic resources; methods and practical experience in forecasting the production and consumption of fuels and energy sources in the U.S.S.R.; and trends in the development of such forecasting methods. Author (ERA)

N78-27574# Futures Group, Gastonbury, Conn.
INCORPORATING UNCERTAINTY IN ENERGY SUPPLY MODELS Final Report
J. G. Stover, W. Hayward, and H. S. Becker Feb. 1978 111 p refs Sponsored by EPRI
(EPRI Proj. 1012-1)
(EPRI-EA-703-Vol-1) Avail: NTIS HC A06/MF A01

A methodology is presented for incorporating uncertainty in simulation models. Uncertainty is incorporated through the introduction of future events that have important impact on the system if they occur, and through the introduction of uncertainty ranges for important exogenous inputs. Cross-impact analysis and Monte Carlo techniques are used to combine this information with the basic simulation model to produce uncertainty ranges for model output. The technique, called probabilistic system dynamics (PSD), is applied to ELECTRIC3, a model of the U.S. electric utility system. ERA

N78-27575# Mathematica, Inc., Washington, D. C.
ESTIMATING HOUSEHOLD ENERGY EXPENDITURES IN THE PHASE 1 COMPREHENSIVE HUMAN RESOURCES DATA SYSTEM, TASK 2 Final Report
Jill A. King Dec. 1977 57 p refs
(Contract EM-74-C-01-8022)
(HCP/I60901-01) Avail: NTIS HC A04/MF A01

Results of revising the electricity and piped-gas expenditures imputed to households on the 1974 Comprehensive Human Resources Data Survey (CHRDS) file with equations estimated from the WCMS 1975 Household Energy Survey are presented. The revised expenditures are shown to be superior to the original CHRDS expenditures in many respects. The adjustment factors necessary to calibrate the expenditures with state-by-state control data are generally smaller than those previously required, and more importantly, the variations in expenditures by different characteristics, including income, age of head, race of head, family size, and tenure are much more reasonable than the original expenditures. Without an absolute standard of the true energy expenditures of the U.S. population by which to assess the CHRDS file, however, it is impossible to conclude that the CHRDS revised electricity and piped-gas expenditures reflect accurately the energy expenditures of different subgroups of the population. Author

N78-27576# Institute of Gas Technology, Chicago, Ill.
TRANSMISSION OF ENERGY BY OPEN-LOOP CHEMICAL ENERGY PIPELINE
N. R. Baker 1977 6 p refs Presented at ERDA-Information Exchange Meeting for Thermal Energy Storage Program, Gatlinburg, Tenn., 29 Sep. 1977
(Contract EE-77-C-02-4234)
(CONF-770955-4) Avail: NTIS HC A02/MF A01

The technical feasibility and the economic viability of transmitting and storing energy by an open-loop modification of the reversible chemical energy pipeline system known as EVA/ADAM were evaluated. Topics studied include: (1) the preliminary design of a nuclear (HTGR) and methane-based open-loop system; (2) assessment of the feasibility of using existing natural gas pipelines and storage systems for the synthesis gas; (3) evaluation of energy sources as alternatives to those in the preliminary design; (4) assessment of existing methanation technologies and interchangeability of the synthetic natural gas (SNG) with natural gas; (5) evaluation of the various alternative energy end-uses for heat, SNG, and electricity; and (6) development of two conceptual designs and evaluation of their economics and environmental impacts. ERA

N78-27577# Organization for Economic Co-Operation and Development, Paris (France).
INTERNATIONAL ENERGY TRENDS: MONTHLY SUPPLEMENT ON OIL TRENDS
16 Dec. 1977 30 p refs
(NP-22885) Avail: NTIS (US Sales Only) HC A03/MF A01; ERDA Depository Libraries

Data on international energy trends are presented in tables and graphs. The data are grouped in sections on consumption of all oil products, consumption by 3 main products, production of crude oil, stock levels of all oil, crude oil imports, average import price for all crude categories, and index of industrial production. ERA

N78-27578# Battelle Pacific Northwest Labs., Richland, Wash.
BRINE CHEMISTRY AND COMBINED HEAT/MASS TRANSFER. VOLUME 2: APPENDIXES
D. W. Shannon Jan. 1978 264 p refs
(Contract EY-76-C-06-1830)
(EPRI-ER-635-Vol-2) Avail: NTIS HC A12/MF A01

Volume II of the two-volume report consists of five appendixes. They are entitled: (1) summary of key input variables for operation of the flashed steam plant computer code; (2) background on component models for fittings and valves; (3) flasher-separator baseline description and performance model; (4) direct contact cascade condenser baseline description and performance; and (5) brine chemistry of geothermal wells listed by resource type. ERA

N78-27579# Exxon Research and Engineering Co., Linden, N. J. Government Research Lab.
HETEROSTRUCTURE SINGLE CRYSTAL SILICON PHOTOVOLTAIC CELL. TYPE A: SEMICONDUCTOR HETEROJUNCTION SILICON DEVICES Quarterly Report, 27 Sep. - 31 Dec. 1976
A. K. Ghosh, R. F. Shaw, T. Feng, C. Fishman, S. Merrin (Emdex Corp., Milford, Conn.), and I. Grater (Emdex Corp., Milford, Conn.) Jan. 1978 39 p refs
(Contract EY-76-C-03-1283)
(TID-27910; QR-1) Avail: NTIS HC A03/MF A01

An account is given of the work that was done on SnO2/Si Heterostructure solar cells. In the Emdex Innotech cells, a major portion of current losses are due to reflection and shadowing effects due to grids. The SnO2 thin films act as an antireflection coating but are not comparable in performance to those used in commercial p/n junction solar cells. The shape of the spectral response curve was theoretically calculated by taking into account the reflection losses. In most cases it is not necessary to assume an inversion layer at the surface to account for the decrease in spectral response at short wavelengths. Further for these cells photocurrent suppression was not observed. The diode factor, the reverse saturation current, series and shunt resistances were determined for these cells. The diode factor n determined from dark and light I-V are not the same as one would expect from a normal solar cell. The first batch of newly fabricated SnO2/Si cells show low efficiency. The problems with these cells and ways to improve its performance are discussed. ERA

N78-27580# Brookhaven National Lab., Upton, N. Y.
ELECTROLYSIS BASED HYDROGEN STORAGE SYSTEM Semiannual Report, 1 Jan. - 30 Jun. 1977
F. J. Salzano Oct. 1977 39 p refs
(Contract EY-76-C-02-0016)
(BNL-50760) Avail: NTIS HC A03/MF A01

The cost and efficiency of electrolytic hydrogen production and the technique of using metal-hydride hydrogen storage for stationary and transportation applications are discussed. The related work of organizations having subcontracts with BNL is included; and the effort on natural-gas supplementation, systems analysis, and project management of the ERDA Hydrogen Program by BNL are summarized. Hardware development and cell materials testing for both acid and alkaline water electrolyzers are included. Also reported is related work on development of the reversible H2Cl2 electrochemical cell which is the key component in an electrical energy storage system proposed for utility use. Progress is reported on solutions to the hydride expansion problem, design of the Hydrogen Technology Advanced Component Test System, design of two hydrogen reservoirs, improved Fe-Ti-based hydrides, and studies on the recovery of storage capacity following poisoning by impurities in the hydrogen. ERA

N78-27581# Hughes Research Labs., Malibu, Calif.
INDIUM PHOSPHIDE/CADMIUM SULFIDE THINFILM TERRESTRIAL SOLAR CELLS Quarterly Report, 1 Jul. - 14 Sep. 1977
K. Zanio and L. Frass Oct. 1977 20 p refs
(Contract EY-76-C-04-3717)
(ALO/3717-1; QR-4) Avail: NTIS HC A02/MF A01

Indium phosphide/cadmium sulfide solar cells with AM2 efficiencies up to 7% were prepared by the deposition of CdS on single crystals of InP. When an intermediate layer of n-type InP was deposited by the planar reactive deposition (PRD) technique, 3% efficiencies were obtained. Reduced efficiencies were obtained when an intermediate layer of p-type Mn-doped InP was used as the light-absorbing layer. Manganese, acting as a deep center at 0.25 eV and introduced in concentrations of about 10 to the 18th power/cubic cm, may act as recombination and tunneling centers, thus limiting the efficiency of the cells. These results suggest that, to improve cell efficiency, either the Mn doping must be reduced or the purity of films must be improved. Methods of improving the purity of the films are suggested. ERA

N78-27582# Brookhaven National Lab., Upton, N. Y.
ROLE OF WIND POWER IN ELECTRIC UTILITIES
H. Davitian Sep. 1977 22 p refs
(Contract EY-76-C-02-0016)
(BNL-50736) Avail: NTIS HC A02/MF A01

Current estimates suggest that the cost of wind generated power is likely to be competitive with conventionally generated power in the near future in regions of the United States with favorable winds and high costs for conventionally generated electricity. This assessment regarding competitiveness includes effects of reduced reliability of wind power compared to conventional sources. Utilities employing wind power are likely to purchase more peaking capacity and less baseload capacity

than they would have otherwise to provide the lowest cost reserve power. This reserve power is needed mainly when wind outages coincide with peak loads. The monetary savings associated with this shift contribute substantially to the value of wind energy to a utility. ERA

N78-27583# State Univ. of New York, Albany.
SOLAR ENERGY AND THE HEAT PUMP IN A NORTHERN CLIMATE Final Report
R. Stewart, J. Healey, B. Murphy, and J. Scott Dec. 1977 68 p refs
(EPRI-EA-407) Avail: NTIS HC A04/MF A01

The performance of copper solar panels with a water-to-water heat pump, an air-to-water heat pump, an electric boiler, and two eight thousand gallon storage tanks is reported. The heated building was instrumented to provide data for the time variant electric power demands, the impact of meteorological variables, peak storage capabilities, the efficiency of the solar panels, coefficient of performance of the heat pumps, and heating system performance factor. Computer simulations of the heat budget of the building were prepared and verified. A series of economic analyses were performed comparing the air source heat pump to the solar assisted water-to-water heat pump and using a base case of electric heating peak shaving. Incremental costs were included but the peak shaving capability was not tested. It is indicated that the air source heat pump has a higher coefficient of performance than the solar assisted water-to-water heat pump. The solar system provides 33% of the heating load during peak winter operating conditions. ERA

N78-27584# George Washington Univ., Washington, D. C.
SOLAR ENERGY INCENTIVES ANALYSIS: PSYCHO-ECONOMIC FACTORS AFFECTING THE DECISION MAKING OF CONSUMERS AND THE TECHNOLOGY DELIVERY SYSTEM
Jan. 1978 52 p
(Contract EX-76-G-01-2534)
(HCP/M2534) Avail: NTIS HC A04/MF A01

The rationale for the study is that economic incentives are necessary, but not sufficient for achieving commercial and residential acceptance. The primary research instrument was 21 Decision Analysis Panel meetings held with groups of Technology Delivery System segment members, and with potential user groups in four regions: the Far West, Southeast, Middle Atlantic and Northeast. Data were analyzed by content and thematic analyses. The major and permanent TDS functions such as financing, manufacturing, distributing, building and installing as well as commercial and private residence consumers are studied. Presented is a broad overview of the behavioral/economic barreirs to solar acceptance; a brief review of how these vary within each TDS and consumer segment studies; and a precis of legislative and programmatic recommendations for Federal, state and local government action. ERA

N78-27585# Ford Motor Co., Dearborn, Mich.
FORD/ERDA SODIUM-SULFUR BATTERY DEVELOPMENT, PHASE 2 Progress Report, 1 Nov. - 31 Dec. 1977
A. Topouzian Feb. 1978 28 p
(Contract EY-76-C-02-2566)
(COO-2566-30; PR-30) Avail: NTIS HC A03/MF A01

Progress is reported in the development of a sodium-sulfur battery. Topics covered include: (1) specifications for an electric vehicle battery to meet a duty cycle of 100 miles CVS; (2) system design and component development for a 1-MW load leveling battery; (3) chromium-nickel alloys for use as the sulfur container material; (4) ceramic electrolyte tubing and sealing problems; and (5) results of cell fabrication and testing. ERA

N78-27586# Department of Energy, Washington, D. C.
DOE FACILITIES SOLAR DESIGN HANDBOOK
Jan. 1978 177 p refs
(Contract W-7405-eng-36)
(DOE/AD-0006/1) Avail: NTIS HC A09/MF A01

Design of solar heating systems for commercial and laboratory buildings at Department of Energy Facilities is discussed. Solar energy fundamentals, solar heating and cooling technology, systems, and components are included as well as solar system economics. Quantitative analysis, with generalized design and sizing curves, is presented for solar heating so that collector and other system parameters can be cost-economically sized without a computer simulation. Solar system design considerations and guidelines, as well as guidelines for developing subsystem specifications, are presented. ERA

N78-27587# Energy Research and Development Administration, Washington, D. C. Office of Planning, Analysis, and Evaluation.
MODELS AND METHODOLOGIES FOR ASSESSING THE IMPACT OF ENERGY DEVELOPMENT
Sep. 1977 41 p refs
(Contract EA-77-C-10-0037)
(ERDA-77-91) Avail: NTIS HC A03/MF A01

The most important community service areas impacted are: housing, transportation, solid waste, water supply, waste water treatment, recreation, education, health care, and public safety. This report surveys the major land use, transportation, economic-demographic, and simulation models and methodologies to analyze their performance vis-a-vis data requirements, model validity and ease of use. GRA

N78-27588# Energy Research and Development Administration, Washington, D. C. Office of Planning, Analysis, and Evaluation.
ASSISTANCE FROM ENERGY DEVELOPERS: A NEGOTIATING GUIDE FOR COMMUNITIES
Sep. 1977 79 p
(Contract EA-77-C-10-0037)
(ERDA-77-90) Avail: NTIS HC A05/MF A01

Public and private policies and actions are considered to increase reliance on more-abundant domestic energy resources such as coal and to develop new technologies to exploit those resources. The focus of this guide is on a general approach and the generic information needed to negotiate for assistance in managing, minimizing, or averting adverse community impacts from energy-development projects. The negotiating process, negotiating leverage, impact and needs assessment, government and developer assistance, and negotiating strategy are discussed. A case study is made of Mineral City County, USA (fictitious), based on experiences of actual communities where a coal gasification plant is located. ERA

N78-27589# Energy Research and Development Administration, Washington, D. C. Office of Planning, Analysis, and Evaluation.
MANAGING THE SOCIO-ECONOMIC IMPACTS OF ENERGY DEVELOPMENT: A GUIDE FOR THE SMALL COMMUNITY
Sep. 1977 82 p
(Contract EA-77-C-10-0037)
(ERDA-77-79) Avail: NTIS HC A05/MF A01

Employment, personal income, housing, education, transportation, water supply, solid waste collection and disposal, waste water treatment, health care, recreation, and safety are among the factors discussed. Emphasis is given to organizing to most effectively participate in assessing, planning, and managing energy development and how to insure that information is collected and analyzed to reflect local priorities and future planning needs within the small community. ERA

N78-27590# Brookhaven National Lab., Upton, N. Y.
DATA BANK FOR THE GEOGRAPHICAL ALLOCATION OF FUTURE US ENERGY SUPPLY FACILITIES BY COUNTY
W. A. Sevian and S. R. Bozzo May 1977 32 p refs
(Contract EY-76-C-02-0016)
(BNL-50754) Avail: NTIS HC A03/MF A01

To aid the analysis and evaluation of the biomedical and environmental effects of future energy systems, a county level data bank of future U.S. energy supply facilities is considered. This data file attempts to fulfill a requirement for a county level information source useful in future energy supply and utilization projections, and the generation of closer links between energy resources, their development and use, and a comprehensive set of the effects of energy consumption. The data file format contains such items as fuel type, process type, year of planned availability, production capacity, employment, and state and county of location for each facility; these formats are described in detail. Finally, a

system that has been developed incorporating the data bank of future energy supply facilities for the analysis of the biomedical and environmental consequences of energy production and consumption is described. ERA

N78-27591# Brookhaven National Lab., Upton, N. Y.
IMPACT OF SELECTED ENERGY CONSERVATION TECHNOLOGIES ON BASELINE DEMANDS
A. Doernberg Sep. 1977 101 p refs
(Contract EY-76-C-02-0016)
(BNL-50745) Avail: NTIS HC A06/MF A01

Baseline energy demands are modified by introducing successively three sets of conservation options. The implementation of improved building standards and the use of co-generation in industry are analyzed in detail. Two further sets of energy demands are presented that complete the view of a low energy use, conservation scenario. An introduction to the report covers the complexities in evaluating conservation in view of the ways it is inextricably lined to technology, prices, policy, and the mix of output in the economy. The term as used in this report is narrowly defined, and methodologies are suggested by which these other aspects listed can be studied in the future. ERA

N78-27592# Argonne National Lab., Ill.
POTENTIAL ENERGY SAVINGS IN COMMERCIAL/RESIDENTIAL COMMUNITIES BASED ON INTEGRATED SYSTEMS DESIGN
R. E. Holtz and T. J. Marciniak 1977 17 p Presented at the Winter Ann. Meeting of the Am. Soc. of Mech. Engr., Atlanta, 22 Nov. 1977
(Contract W-31-109-eng-38)
(CONF-771120-21) Avail: NTIS HC A02/MF A01

Integrated Community Energy Systems (ICES) offer the potential of meeting the total energy requirements of communities in an energy conserving cost effective manner. This is accomplished mainly by (1) utilizing waste heat from electrical power generation; (2) using solid waste to help meet thermal and fuel energy demands; (3) using solar and other advanced technologies either in a central plant or dispersed in the community; and (4) developing control and operating strategies along with energy-storage technologies to meet community energy needs. In order to explore the potential for such systems, a large commercial/residential community currently under development in the Midwest was studied. Results are presented showing the energy savings possible using current, emerging, and advanced energy technologies. Along with the energy savings are estimates of the economic savings that are possible are included. ERA

N78-27593# General Electric Co., Schenectady, N. Y. Energy Systems Programs Dept.
CFCC DEVELOPMENT PROGRAM Monthly Report, Nov. 1977
Jan. 1978 27 p refs
(Contract EX-76-C-01-2357)
(FE-2357-19) Avail: NTIS HC A03/MF A01

System engineering effort has been focused on two areas, in order to guide evolving technology investigations. The first, the interaction of alternate combustor steam generator configuration addresses the control and mechanical interface issues. The second, a study of conventional cyclone utilization, is being used to guide the advanced inertial separator development. Several combustor/steam generator concepts have been conceptualized including a shippable configuration (four vessels per gas turbine) and a modified tube geometry (involute) resulting in two vessels per turbine module. In the gas turbine materials area, over 1000 hours have been accumulated on the burner rig simulations and some of the baseline materials are showing initial signs of corrosion--hence, they have removed and will undergo analysis. Materials for exposure in the PFB environment as part of the Fireside II 1000 hours test have been selected and specimen cladding has been initiated. ERA

N78-27594# Booz-Allen and Hamilton, Inc., Bethesda, Md.
VIEWPOINTS ON KEY ISSUES AND EVALUATION CRITERIA FOR ASSESSING THE POTENTIAL OF ALTERNATIVE NUCLEAR ENERGY SYSTEMS FOR IMPROVING PROLIFERATION RESISTANCE
15 Dec. 1977 107 p refs
(Contract EN-77-C-01-2644)
(TID-28078) Avail: NTIS HC A06/MF A01

A compilation and analysis of the viewpoints offered by individuals representative of the spectrum of groups interested in the proliferation problem is presented. These individuals were selected from utilities, the nuclear industry, the Federal Government, state government staff, Congressional staff, environmental organizations, universities, an energy analysis organization, national energy laboratories, and a public policy analysis organization. The major issues, concerns, and implications identified in the course of this effort are discussed. This analysis of viewpoints is intended to assist DOE in the planning and conduct of a Nonproliferation Alternative System Assessment Program (NASAP). Information is presented in the following formats: framework for analysis; alternative systems assessment criteria; integrated evaluation methodology; and public interaction. ERA

N78-27595# Sandia Corp., Livermore, Calif.
DIRECT CONTACT HEAT EXCHANGE FOR LATENT HEAT-OF-FUSION ENERGY STORAGE SYSTEMS
M. C. Nichols and R. M. Green Dec. 1977 28 p refs Presented at alternative energy sources Symp., Miami Beach, Fla., 5 Dec. 1977
(Contract EY-76-C-04-0789)
(SAND-77-8665; Conf-771203) Avail: NTIS HC A03/MF A01

Rudimentary computational and experimental results are presented for a thermal energy storage process based on a novel counter current, direct contact heat exchange concept, the shot tower. The process uses a phase change material and a mutually immiscible heat transfer fluid. A two-tank storage system is used, one each for cool and hot phase change material, respectively. In use, the phase change material is introduced from one of the storage tanks into a direct contact heat exchanger where it is frozen/melted while it passes through the countercurrently flowing heat transfer fluid which receives/supplies heat from/to the phase change material. Since these external heat exchangers need only be sized to meet the charge/discharge power demand, they can be quite small relative to the size of the storage tanks. The extensive and expensive heat exchanger surfaces required in conventional phase change systems can be totally eliminated. ERA

N78-27596# Aerospace Corp., El Segundo, Calif. Environment and Energy Conservation Div.
HYBRID VEHICLE TECHNOLOGY CONSTRAINTS AND APPLICATION ASSESSMENT STUDY. VOLUME 1: SUMMARY Final Report, Apr. 1975 - Jun. 1976
D. E. Lapedes, M. G. Hinton, L. Forrest, J. Kohlenberger, T. Ryan, H. Sampson, W. Smalley, C. Speisman, and H. White Nov. 1977 117 p 4 Vol.
(PB-278118/5; DOT-TSC-OST-77-23-1-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 13F

Analyses and assessments of both heat engine/battery and heat engine/flywheel-powered hybrid vehicles are presented to determine if they could contribute to nearterm (1980-1990) reductions in transportation energy consumption. The impact of hybrid vehicle use on vehicle-related exhaust emissions is determined, and the ability to accommodate a different energy resource base in the longer term is evaluated. Alternative paths for power transmission from the heat engine to the vehicle drive wheels are considered along with the potential of regenerative braking to reduce vehicle energy consumption. GRA

N78-27597# Aerospace Corp., El Segundo, Calif. Environment and Energy Conservation Div.
HYBRID VEHICLE TECHNOLOGY CONSTRAINTS AND APPLICATION ASSESSMENT STUDY. VOLUME 2: SECTIONS 1 THROUGH 4 Final Report, Apr. 1975 - Jun. 1976
D. E. Lapedes, M. G. Hinton, L. Forrest, J. Kohlenberger, T. Ryan, H. Sampson, W. Smalley, C. Speisman, and H. White Nov. 1977 225 p refs 4 Vol.
(PB-278119/3; DOT-TSC-OST-77-23-2-Vol-2) Avail: NTIS HC A10/MF A01 CSCL 13F

The methods used and the data base employed in simulation modeling of each vehicle powertrain are presented. A technology

review of powertrain components and various hybrid systems are included. GRA

N78-27598# Aerospace Corp., El Segundo, Calif. Environment and Energy Conservation Div.
HYBRID VEHICLE TECHNOLOGY CONSTRAINTS AND APPLICATION ASSESSMENT STUDY. VOLUME 3: SECTIONS 5 THROUGH 9 Final Report, Apr. 1975 - Jan. 1976
D. E. Lapedes, M. G. Hinton, L. Forrest, J. Kohlenberger, T. Ryan, H. Sampson, W. Smalley, C. Speisman, and H. White Nov. 1977 188 p refs 4 Vol.
(PB-278120/1; DOT-TSC-OST-77-23-3-Vol-3) Avail: NTIS HC A09/MF A01 CSCL 13F

Vehicle powertrain characteristics and the characteristics of the stationary generating plants are described along with physical and performance characteristics imposed on the hybrid vehicle. Computer programs developed for the analysis and results of the powertrain component sizing analysis are included. GRA

N78-27599# Aerospace Corp., El Segundo, Calif. Environment and Energy Conservation Div.
HYBRID VEHICLE TECHNOLOGY CONSTRAINTS AND APPLICATION ASSESSMENT STUDY. VOLUME 4: SECTIONS 10, 11, AND APPENDIX Final Report, Apr. 1975 - Jun. 1976
D. E. Lapedes, M. G. Hinton, L. Forrest, J. Kohlenberger, T. Ryan, H. Sampson, W. Smalley, C. Speisman, and H. White Nov. 1977 212 p ref 4 Vol.
(PB-278121/9; DOT-TSC-OST-77-23-4-Vol-4) Avail: NTIS HC A10/MF A01 CSCL 13K

The hybrid vehicle's energy consumption and exhaust emissions are considered. Factors such as vehicle weight, peak cruise speed, and regenerative braking are discussed. Technological constraints to introduction of the hybrid vehicle and applications that could benefit most from its energy conservation potential are identified. GRA

N78-27600 National Technical Information Service, Springfield, Va.
WIND POWER, VOLUME 1. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - 1976
Audrey S. Hundemann May 1978 206 p
(NTIS/PS-78/0415/6) Avail: NTIS HC $28.00/MF $28.00 CSCL 10B

The feasibility, use, and engineering aspects of wind power and windmills are discussed in these citations of Federally-funded research reports. Abstracts primarily cover the use of wind power for electric power generation and wind turbine design and performance. General studies dealing with comparative analysis of wind power and alternative energy sources are included, as are energy storage devices which can be used in these systems. GRA

N78-27601 National Technical Information Service, Springfield, Va.
WIND POWER, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Apr. 1978
Audrey S. Hundemann May 1978 158 p Supersedes NTIS/PS-77/0399; NTIS/PS-76/0358; NTIS/PS-75/348; COM-74-11103
(NTIS/PS-78/0416/4; NTIS/PS-77/0399; NTIS/PS-76/0358; NTIS/PS-75/348; COM-74-11103) Avail: NTIS HC $28.00/MF $28.00 CSCL 10B

For abstract, see N78-27600.

N78-27602 National Technical Information Service, Springfield, Va.
WIND POWER. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Apr. 1978
Audrey S. Hundemann May 1978 238 p Supersedes NTIS/PS-77/0400; NTIS/PS-76/0359
(NTIS/PS-78/0417/2; NTIS/PS-77/0400; NTIS/PS-76/0359) Avail: NTIS CSCL 10B

For abstract, see N78-27600.

N78-27603# Office of Technology Assessment, Washington, D. C.
TASK REPORTS: SLURRY COAL PIPELINES, VOLUME 2, PART 1
Jan. 1978 528 p refs
(PB-278676/2; OTA-E-60-Vol-2-Pt-1) Avail: NTIS HC A23/MF A01 CSCL 13K

The costs and potential economic, social, and environmental impacts of coal slurry pipelines are analyzed. The possible effects of coal slurry pipeline development, pipeline and unit train costs, and relevant legal and regulatory issues are discussed. Findings address conditions under which slurry pipelines may be attractive in terms of cost and the influence of transportation regulatory policy. Also evaluated are the potential impacts of slurry pipeline development on the rail industry, consequences of pipeline water use as contrasted with community impacts of increased coal train traffic, and implications of the power of eminent domain at the Federal, as opposed to the state, level. GRA

N78-27604# Office of Technology Assessment, Washington, D. C.
TASK REPORTS: SLURRY COAL PIPELINES, VOLUME 2, PART 2
Jan. 1978 804 p refs
(PB-278677/0; OTA-E-60-Vol-2-Pt-2) Avail: NTIS HC A99/MF A01 CSCL 13K

For abstract, see N78-27603.

N78-27605# Illinois Dept. of Business and Economic Development, Springfield. Div. of Energy.
ILLINOIS ENERGY CONTINGENCY PLAN, EXECUTIVE SUMMARY Final Report
W. Poulakos Dec. 1977 29 p
(Contract GR-25-0017-112)
(PB-278714/1; ILLDOE-77/14) Avail: NTIS HC A03/MF A01 CSCL 10A

The role of state agencies during energy contingencies is described. The executive summary outlines the information system and the various components within the energy contingency plan. The executive summary briefly discusses possible policy options which may be used by the state during energy contingencies. GRA

N78-27606# Illinois Dept. of Business and Economic Development, Springfield. Div. of Energy.
ILLINOIS ENERGY CONTINGENCY PLAN Final Report
H. Kaufman and V. Shrivastava (Jack Faucett Associates, Inc.) Nov. 1977 188 p
(Contract GR-25-0017-112)
(PB-278715/8; ILLDOE-77/13) Avail: NTIS HC A09/MF A01 CSCL 10A

An information system reported for use during energy emergencies. There are four major components to the Illinois Plan. These components are information analysis, advisory, decision making, and implementation. The Plan describes the role of various state agencies during times of energy contingencies and policy options which may be considered by the state during various types of energy disruptions. Some quantification of demand reduction measures are listed in the Plan. GRA

N78-27607# Environmental Protection Agency, Denver, Colo. Office of Energy Activities.
FEDERALLY SPONSORED ENERGY RESEARCH IN THE NORTHERN GREAT PLAINS, NORTH DAKOTA, FISCAL YEAR 1976
Allen S. Lefohn Jun. 1977 37 p refs
(PB-278132/6; EPA-908/4-77-008) Avail: NTIS HC A03/MF A01 CSCL 10A

An effective mechanism for transferring energy research results from the laboratory to the decision makers is considered. A survey was initiated to summarize the federal energy effort in the State of North Dokota. This report is a summary of the information obtained from numerous state and federal publications. Recommendations regarding further actions on various aspects of energy research are included. The report serves primarily as an information mative document to inform researchers, state and federal government officials, and decision-makers at all government levels how and where the federal energy research dollar is being directed in North Dakota. GRA

N78-27608# Development Sciences, Inc., Sagamore, Mass.
FIRST ORDER ESTIMATES OF ENERGY REQUIREMENTS FOR POLLUTION CONTROL
James L. Barker, Kenneth Maddox, James D. Westfield, and Douglas Wilcock Feb. 1978 97 p refs
(Contract EPA-68-01-4150)
(PB-278274/6; EPA-600/7-78-022) Avail: NTIS HC A05/MF A01 CSCL 10A

Estimates of the energy demand attributable to environmental control of pollution from stationary point sources are presented. This class of pollution source includes powerplants, factories, refineries, municipal waste water treatment plants, etc., but excludes mobile sources - automobiles, trucks, etc. - and nonpoint sources - sources which do not produce individual effluent streams, such as some types of farms, mines, etc. GRA

N78-27609# National Technical Information Service, Springfield, Va.
COAL GASIFICATION AND LIQUEFACTION TECHNOLOGY, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Jun. 1976 - Apr. 1978
Diane M. Cavagnaro Apr. 1978 282 p Supersedes NTIS/PS-77/0305, NTIS/PS-76/0391, NTIS/PS-75/386 and COM-74-10967
(NTIS/PS-78/0345/5; NTIS/PS-77/0305; NTIS/PS-76/0391; NTIS/PS-75/386; COM-74-10967) Avail: NTIS HC $28.00/MF $28.00 CSCL 07A

Techniques and processes of the conversion of coal to gaseous and liquid chemicals are cited in this bibliography. It also includes solvent refined coal liquids and coal derived fuels. Coal desulfurization, cleaning, or preparation which does not involve conversion to gas or liquid fuels, or in situ combustion (underground gasification of coal deposits) are not covered. (This updated bibliography contains 277 abstracts, 157 of which are new entries to the previous edition.) GRA

N78-28039# Joint Publications Research Service, Arlington, Va.
PROSPECTS FOR POWER GENERATION FROM SPACE
I. Zorich *In its* Transl. on USSR Sci. and Technol. (JPRS-71393) 30 Jun. 1978 p 38-41 Transl. into ENGLISH from Nedelya (Moscow), no. 20, 1978 p 11 (For primary document see N78-28033 18-99)
Copyright. Avail: NTIS HC A05/MF A01

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N78-27610 Tennessee Univ., Knoxville.
FUNCTIONAL COMPLEXITY AND ECOSYSTEM STABILITY: AN EXPERIMENTAL APPROACH Ph.D. Thesis
Peter VanVoris 1977 128 p
Avail: Univ. Microfilms Order No. 7807732

The complexity-stability hypothesis was experimentally tested using intact terrestrial microcosms. Functional complexity was defined as the number and significance of component interactions (i.e., population interactions, physical-chemical reactions, and biological turnover rates) influenced by nonlinearities, feedbacks, and time delays. It was postulated that functional complexity could be nondestructively measured through analysis of a signal generated from the system. Power spectral analysis of hourly CO2 efflux, from eleven old-field microcosms, was analyzed for the number of low frequency peaks and used to rank the functional complexity of each system. Ranking of ecosystem stability was based on the capacity of the system to retain essential nutrients and was measured by net loss of Ca after the system was stressed. Rank correlation supported the hypothesis that increasing ecosystem functional complexity leads to increasing exosystem stability. Dissert. Abstr.

N78-27611 South Florida Univ., St. Petersburg.
ENVIRONMENTAL-ANALYTICAL STUDIES OF ANTIMONY, GERMANIUM AND TIN Ph.D. Thesis
Michael Anthony Tompkins 1977 246 p
Avail: Univ. Microfilms Order No. 7809327

An emission type detector system combined with sample preconcentration utilizing covalent hydride generation was adapted for the detection and determination of the inorganic and the simple methylated forms of antimony, germanium and tin. The greater sensitivity of the flame emission detector, resulted in the identification of methylated forms of tin in the various samples analyzed. Biological methylation of tin in the body and in the environment was established for the first time. While the concentrations found are low, in the parts per trillion range, the methylated forms of tin were found to comprise a substantial fraction, 14 to 60 percent, of the total tin content of many water samples. Dissert. Abstr.

N78-27612 Miami Univ., Coral Gables, Fla.
A NUMERICAL INVESTIGATION OF THERMAL PLUMES Ph.D. Thesis
Josyula Venkata 1977 403 p
Avail: Univ. Microfilms Order No. 78082556

A three dimensional numerical model for a near field thermal discharge is developed. The basic equations considered are continuity, three momentum (u,v,w) and the energy equations. A Poisson equation derived from the vertically integrated horizontal momentum equations is used as a predictive equation for pressure. The boundary conditions secify surface wind stress and heat transfer coefficient at air water interface. Explicit schemes are used in time to integrate the velocity and temperature equations. The model is applied to varying conditions of wind, bottom topography and initial conditions. The effect of eddy coefficients is investigated. The effect of bottom slope, Reynolds number (Re) and Froude number (FR) on three dimensional surface jets was investigated. The effects on jet width growth, centerline decay and virtual origins are presented. Dissert. Abstr.

N78-27613*# Savannah State Coll., Ga.
STUDIES ON THE TOXIC ELEMENTS AND ORGANIC DEGRADATION PRODUCTS IN AQUATIC BODIES AND SEDIMENTS AROUND KENNEDY SPACE CENTER (KSC) SOUTH MOSQUITO LAGOON Annual Report, Dec. 1976 - Mar. 1978
G. S. Ghuman, M. P. Menon, and C. Obi Emeh Mar. 1978 88 p refs
(Grant NsG-803)
(NASA-CR-157257; AR-3) Avail: NTIS HC A05/MF A01 CSCL 13B

A compilation was put together of research work performed on the aquatic systems around Kennedy Space Center (KSC). The report includes a brief description of the study area, field data and analytical results of all the samples collected during the five visits to KSC up to December 17, 1977. The aquatic area selected for the study is the Southern part of Mosquito Lagoon which extends from the Haulover Canal to the dead end boundary of this lagoon southwards. L.S.

N78-27614*# Old Dominion Univ., Norfolk, Va. Dept. of Physics and Geophysical Sciences.
AN EXPERIMENTAL/ANALYTICAL PROGRAM TO ASSESS THE UTILITY OF LIDAR FOR POLLUTION MONITORING Final Report, 1 Sep. 1976 - 31 Oct. 1977
Frank S. Mills, Robert J. Allen, Carolyn F. Butler, and Earl C. Kindle Jun. 1978 46 p refs
(Grant NsG-1343)
(NASA-CR-157302; PGSTR-AP78-9) Avail: NTIS HC A03/MF A01 CSCL 13B

The development and demonstration of lidar techniques for the remote measurement of atmospheric constituents and transport processes in the lower troposphere was carried out. Particular emphasis was given to techniques for monitoring SO2 and particulates, the principal pollutants in power plant and industrial plumes. Data from a plume dispersion study conducted in Maryland during September and October 1976 were reduced, and a data base was assembled which is available to the scientific community for plume model verification. A UV Differential Absorption Lidar (DIAL) was built, and preliminary testing was done. L.S.

N78-27615# North Carolina Water Resources Research Inst., Raleigh.

ORGANIC CARBON AND DEOXYGENATION IN THE PAMLICO RIVER ESTUARY
Graham J. Davis (East Carolina Univ., Greenville), Mark M. Brinson (East Carolina Univ., Greenville), and William A. Burke (East Carolina Univ., Greenville) Jan. 1978 141 p refs
(PB-278311/6; UNC-WRRI-78-131; W78-04816; OWRT-A-088-NC(2)) Avail: NTIS HC A07/MF A01 CSCL 13B

The distribution, sources and sinks of organic carbon were studied in the Pamlico River Estuary during 1975-1977. The main source of organic carbon was from phytoplankton productivity, which, together with other sources from within the estuary, provided 64% of the organic carbon inputs. The remaining 36% was mainly from tributaries. Organic carbon losses (sinks) were 80% as water column respiration and 20% as outflow. Sedimentation and benthic respiration are undertermined losses. GRA

N78-27616# East-West Gateway Coordinating Council, East St. Louis, Ill.
AIR QUALITY, PUBLIC INFORMATION AND TRANSPORTATION STRATEGIES Final Report, Dec. 1976 - Jun. 1977
M. James Bogart Jun. 1977 69 p
(Contract EPA-68-02-2531)
(PB-279027/7; EWG-JB-0333; EPA-907/9-77-006) Avail: NTIS HC A04/MF A01 CSCL 13B

Air quality activities are summarized. An areawide public information campaign was conducted and various transportation control strategies designed to reduce excessive air pollution levels in the St. Louis air quality control region were developed and promoted. GRA

N78-27617# United Technologies Research Center, East Hartford, Conn.
THE EVOLUTION OF POLLUTANTS DURING THE RAPID DEVOLATILIZATION OF COAL Final Report, 1 Apr. 1976 - 30 Sep. 1977
Peter R. Solomon Nov. 1977 262 p
(Grant NSF AER-75-17247)
(PB-278496/5; R77-952588-3; NSF/RA-770422) Avail: NTIS HC A12/MF A01 CSCL 08I

Results are described of an eighteen month integrated experimental and analytical program to study the evolution of pollutants during coal devolatilization. The identification of individual reactions was facilitated by performing the devolitization experiments in vacuum. The program investigated the devolatilization behavior of 13 coals ranging in rank from lignite to highly volatile A bituminous. The coal was brought to temperature at a nominal heating rate of 600 C/sec, held at temperatures between 300 and 1000 C for between 5 sec and 80 sec and then cooled. Measurements were made of particle temperature, the elemental composition and mass distribution of the products, and the concentration of components in the gas. GRA

N78-27618# Westinghouse Research and Development Center, Pittsburgh, Pa.
ALTERNATIVES TO CALCIUM-BASED SO2 SORBENTS FOR FLUIDIZED-BED COMBUSTION: CONCEPTUAL EVALUATION Final Report, Dec. 1975 - Dec. 1976
Richard A. Newby and Dale L. Keairns Jan. 1978 142 p refs
(Contract EPA-68-02-2132)
(PB-278332/2; EPA-600/7-78-005) Avail: NTIS HC A07/MF A01 CSCL 07A

Results of a conceptual engineering evaluation to screen supported metal oxides as alternatives to natural calcium-based sorbents (limestones and dolomites) are considered for SO2 control in atmospheric and pressurized fluidized-bed combustion (FBC) processes. Alternative sorbents were evaluated, using three acceptance criteria: SO2 removal capability in the combustor, predicted by thermodynamics; SO2 concentrations achievable in the regenerator off-gas, according to thermodynamics; and SO2 concentrations off the regenerator, acheivable based on material and energy balances. The evaluation identified 14 potentially acceptable sorbents for atmospheric FBC, and 11 for pressurized FBC. GRA

N78-27619# Aerospace Corp., El Segundo, Calif. Ivan A. Getting Lab.
THE ROLE OF SOLID-GAS INTERACTIONS IN AIR POLLUTION Final Report, Nov. 1973 - Feb. 1977
Henry S. Judeikis, Thomas B. Stewart, Anthony G. Wren, and James E. Foster Dec. 1977 71 p refs
(Grant EPA-R-802687)
(PB-279019/4; EPA-A-600/3-77-132) Avail: NTIS HC A04/MF A01 CSCL 04A

Sulfur dioxide and other sulfur containing gases were studied to evaluate their interactions with solids likely to be found in urban aerosols and on ground level surfaces in the urban environment. Results indicate that sulfur dioxide readily reacts with most of these materials by capacity limited reactions, particularly at high relative humidities. Removal of hydrogen sulfide and dimethylsulfide over ground level surfaces is a slow process and largely reversible. The implications of these results with regard to air pollution chemistry and sulfur control strategies are discussed. GRA

N78-27620# Monsanto Research Corp., Dayton, Ohio.
SOURCE ASSESSMENT: POLYCHLOROPRENE. STATE OF THE ART Final Task Report, Mar. 1975 - Jul. 1977
D. A. Horn, D. R. Tierney, and T. W. Hughes Dec. 1977 97 p refs
(Contract EPA-68-02-1874)
(PB-278777/8; EPA-600/2-77-107o; MRC-DA-718) Avail: NTIS HC A05/MF A01 CSCL 07A

The state of the art of air emissions from polychloroprene manufacture was reviewed. The composition, quality, and rate of emissions, and their environmental effects are described. Polychloroprene was produced by the emulsion polymerization of 2-chloro-1, 3-butadiene (chloroprene). Emissions included hydrocarbons, particulate, hydrogen chloride, and nitrogen oxides. To assess the severity of emissions from the industry, a representative plant was defined based on mean values for plant parameters. GRA

N78-27621# Environmental Protection Agency, Research Triangle Park, N.C. Emission Standards and Engineering Div.
STANDARDS SUPPORT AND ENVIRONMENTAL IMPACT STATEMENT. VOLUME 2: PROMULGATED STANDARDS OF PERFORMANCE FOR LIGNITE-FIRED STEAM GENERATORS
Nov. 1977 34 p
(PB-279008/7; EPA-450/2-76-030b) Avail: NTIS HC A03/MF A01 CSCL 07A

A standard of performance for the control of emissions of nitrogen oxides from new and modified lignite fired steam generators is being promulgated under the authority of section III of the Clean Air Act. When standards of performance for large steam generators were promulgated under Subpart D of Part 60, lignite fired units were exempted from the nitrogen oxides standard (the sulfur dioxide and particular matter standards are applicable to lignite firing) because of a lack of data on attainable levels of emission from such units. Since then, sufficient data have been obtained to propose and promulgate a standard. This document contains summaries of public comments on the proposed standards, EPA responses, a discussion of differences between the proposed and promulgated standards, and the final environmental impact statement as submitted to the Council on Environmental Quality. GRA

N78-27622# PEDCO-Environmental Specialists, Inc., Cincinnati, Ohio.
EPA UTILITY FGD (FLUE GAS DESULFURIZATION) SURVEY: DECEMBER 1977 - JANUARY 1978 Progress Report, Jul. 1977 - Jan. 1978
Bernard A. Laseke Mar. 1978 291 p
(PB-279011/1; EPA-600/7-78-051a) Avail: NTIS HC A13/MF A01 CSCL 07A

A survey of utility flue gas desulfurization (FGD) systems in the U.S. is presented. Information contributed by the utility industry, process suppliers, regulatory agencies, and consulting engineering firms, is summarized. Systems were tabulated alphabetically, by development status by utility company, process supplier, processes, waste disposal practice, and by regulatory class. Data on system design, fuel sulfur content, operating history, and actual performance are presented. Problems and solutions

associated with the boilers and FGD systems are discussed.
GRA

N78-27623# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
CONTROL OF EMISSIONS FROM LURGI COAL GASIFICATION PLANTS
Mar. 1978 178 p refs
(PB-279012/9; EPA-450/2-78-012; OAQPS-1.2-093) Avail: NTIS HC A09/MF A01 CSCL 07A

Information on Lurgi coal gasification plants, their emissions, control technologies which can be used to control emissions, and the environmental and economic impacts of applying these control technologies was provided. GRA

N78-27624# Southern Research Inst., Birmingham, Ala.
PARTICULATE SAMPLING SUPPORT: A 1977 Annual Report, 1977
K. M. Cushing, William Farthing, L. G. Felix, J. D. McCain, and W. B. Smith Jan. 1978 177 p refs
(Contract EPA-68-02-2131)
(PB-279170/5; SORI-EAS-77-661; EPA-600/7-78-009) Avail: NTIS HC A09/MF A01 CSCL 07D

The activities supporting the particulate sampling efforts of EPA/IERLRTP during FY 1977 are described. Twenty technical directives were issued in seven categories: cascade impactors (7), cyclones (5), sampling electrostatic precipitators (1), guidelines and manuals (3), document review (1), consulting services (2), and advanced concepts (1). Significant results of the 12 completed tasks are presented. GRA

N78-27625# Exxon Research and Engineering Co., Linden, N. J. Products Research Div.
HYDROGEN CYANIDE EMISSIONS FROM A THREE-WAY CATALYST PROTOTYPE Final Report
Eugene L. Holt and Mary H. Keirns Nov. 1977 69 p refs
(Contract EPA-68-03-2485)
(PB-279037/6; EPA-460/3-77-023) Avail: NTIS HC A04/MF A01 CSCL 07D

Four catalysts, nominally identical except for Pt/Rh ratio, were tested for emissions of regulated pollutants and for HCN, NH3, SO4(-2) and H2S. Fuel economy was also measured. The tests were conducted over the FTP, CDFS, and 64 and 80 kph cruise modes, using three simulated malfunction modes: O2 sensor disconnected-idle adjustment correct; O2 sensor disconnected-idle adjustment enriched; 13% misfire. A prototype Volvo TWC vehicle was the test car. The four catalysts contained respectively: Rh only, 17% Rh-Pt; 5% Rh-Pt; Pt only. Tests were also run with no catalyst under the malfunction modes and with each catalyst under normal engine conditions. Of the fifteen possible test combinations, twelve were chosen to be run, with four replicates, giving sixteen runs total. No HCN was detected at the tailpipe under normal operating conditions over the FTP. However, under the malfunction modes, HCN emissions were generally found.
GRA

N78-27626# Environmental Monitoring and Support Lab., Research Triangle Park, N. C.
COLLABORATIVE STUDY OF EPA METHOD 13A AND METHOD 13B
William J. Mitchell, Jack C. Suggs, and Fred J. Bergman (Midwest Res. Inst., Kansas City) Sep. 1977 78 p refs
(PB-278849/5; EPA-600/4-77-050) Avail: NTIS HC A05/MF A01 CSCL 14B

The results from a collaborative test of U.S. EPA Method 13A and 13B are presented. The collaborative test was conducted at a primary aluminum reduction plant. In the collaborative test, six laboratories each operated two Method 13 sampling trains and all laboratories simultaneously sampled the same stack. Ten such sampling runs were done for a total of 120 samples. Each source sample was analyzed for fluoride using both Method 13A and Method 13B. The results of the collaborative test showed that both test methods gave similar results. GRA

N78-27627# Rockwell International Corp., Creve Couer, Mo. Air Monitoring Center.
REGIONAL AIR POLLUTION STUDY: CRITERIA AND NON-CRITERIA POLLUTANT SOURCE TESTING PROGRAM Final Report
F. E. Littman, R. W. Griscom, and O. Klein Nov. 1977 240 p
(Contract EPA-68-02-2093)
(PB-278847/9; EPA-600/4-77-044) Avail: NTIS HC A11/MF A01 CSCL 14B

To enhance the accuracy of the emission inventory for the Regional Air Pollution Study (RAPS), a special emission factor development program was conducted on many of the large emission sources. Source testing of typical sources was carried out using standard EPA methods. Data for the criteria pollutants -- SO2, NOx, HC, CO, and particulate matter -- were obtained, as well as for H2SO4 mist and particle size distribution. Results indicate good agreement between measured and calculated SO2 values. Agreement of NOx and particulate values between actual tests and results calculated using standard emission factors is variable. GRA

N78-27628# Civil and Environmental Engineering Development Office, Tyndall AFB, Fla. Detachment 1, ADTC
EQUIPMENT TO NEUTRALIZE AIRCRAFT FUEL SPILLS Final Report, Sep. 1976 - Sep. 1977
Lee R. Munroe Jan. 1978 40 p
(AD-A053862; CEEDO-TR-78-09) Avail: NTIS HC A03/MF A01 CSCL 06/6

This report describes the selection of types and sizes of equipment for the neutralization of small and other type fuel spills. Additionally, it deals with the procurement of subject equipment and materials; and, evaluates, on a competitive basis, for application to collection, neutralization, and fabrication of various size fuel spills. Maximum use was made of US Army Mobility Equipment Research and Development Command's in-house facilities to design, assemble, fabricate, and test a pilot model system as described in the report. Author (GRA)

N78-27629# Ryckman, Edgerley, Tomilinson, and Associates, St. Louis, Mo.
FEASIBILITY STUDY OF VACUUM FILTRATION SYSTEMS FOR DEWATERING DREDGED MATERIAL Final Report
Bruce W. Long and Dominic J. Grana Feb. 1978 174 p refs
(Contract DACW39-75-C-0124)
(AD-A053773; WES-TR-D-78-5) Avail: NTIS HC A08/MF A01 CSCL 13/2

A laboratory study was performed of the feasibility of dewatering dredged material by vacuum filtration. Characterizations were made for samples from six disposal areas: Penns Neck Spillway, Apalachicola Bay, Mobile Bay, Toledo Harbor, Craney Island, and Browns Lake. Investigations of particle size distribution, specific resistance to filtration, filter leaf studies, and bench-scale vacuum filtration studies were conducted. The samples collected were diluted to between 8 and 25 percent solids by weight and chemically conditioned for the various testing procedures. Seven chemical coagulants were investigated. The results attained indicated that dredged material from the different sites could be effectively dewatered to 45 to 60 percent solids (depending on the site) using lime dosages of 7 to 10 percent of the solids in the sample. Filter yields of up to 9.0 lb solids per square foot per hour were observed. The quality of the filtrate was generally in the range of 500 to 1500 mg/l suspended solids. Field studies of a pilot are recommended to further evaluate the operating parameters of vacuum filtration under actual conditions. Author (GRA)

N78-27630# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
JEREMIAH ENVIRONMENTAL COMPUTATIONAL SYSTEM
M. R. Buckner 1977 13 p refs Presented at the Am. Nucl. Soc. Winter Meeting, San Francisco, 27 Nov. - 2 Dec. 1977
(Contracts EY-76-C-09-0001; AT(07-2)-1)
(DP-MS-77-41; Conf-771109-93) Avail: NTIS HC A02/MF A01

A modular environmental transport and dose computational system (JEREMIAH) was developed to assess routine radioactive pollutant releases and emergency response capability for accidental pollutant releases. This system uses the modular programming interfaces and data management facilities provided by the JOSHUA operating system. The JEREMIAH system is primarily designed to handle pollutant releases from the Savannah River

Plant; however, other nuclear facilities within the southeastern United States are included in the grid networks provided within JEREMIAH. ERA

N78-27631# Battelle Pacific Northwest Labs., Richland, Wash. Dept. of Atmospheric Sciences.

ESTIMATION OF AIR CONCENTRATIONS DUE TO THE DIFFUSION, DEPOSITION AND RESUSPENSION OF CONTAMINANTS BY THE WIND Ph.D. Thesis - Washington Univ.

Thomas William Horst Oct. 1977 150 p refs

(Contract EY-76-C-06-1830)

(PNL-2426) Avail: NTIS HC A07/MF A01

A model is developed for the prediction of the air concentration of a pollutant in the presence of a vertical flux of the material at the surface. This surface flux model integrates over the horizontal extent of the surface source/sink, assuming that the atmospheric diffusion from each differential increment of area is equal to that from a surface point source. Two specific processes are considered in specifying the areal source strength: a negative vertical flux due to dry deposition and a positive vertical flux due to the suspension of surface contamination by the wind. The deposition flux is assumed to be equal to the product of the near-surface air concentration and a deposition velocity v/sub d/ and the suspension flux to the product of the surface contamination and a resuspension rate A. It is shown that the surface flux model leads to a new method of accounting for deposition from a point source plume, called surface depletion, which allows empirical knowledge about the diffusion process to be applied directly to the diffusion of a depositing material. ERA

N78-27632# California Univ., Berkeley. Lawrence Berkeley Lab.

AUTOMATED ELEMENTAL ANALYSIS USING ENERGY DISPERSIVE X-RAY FLUORESCENCE ANALYSIS

J. M. Jaklevic, R. C. Gatti, F. S. Goulding, B. W. Loo, and A. Thompson Nov. 1977 8 p refs Presented at the 4th Joint Conf. on Sensing of Environ. Pollutants, New Orleans, 6 Nov. 1977

(Contract W-7405-eng-48)

(LBL-7211; Conf-771113-12) Avail: NTIS HC A02/MF A01

The application of energy dispersive X-ray fluorescence analysis to the measurements of air particulate samples are described as well as the completion of a program in which a total of 34,000 air particulate samples were collected and analyzed over the past two years. An automatic photon excited energy dispersive spectrometer was used to obtain elemental concentration for 27 elements on each sample. The sensitivity of the system is adequate to detect quantities of 10ngm/sq cm or less in about six minutes per sample. The precision and accuracy of the results were compared to statistical analyses of the data set. Summaries of the results are presented and the implications for air particulate monitoring are discussed. ERA

N78-27633# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.

PRIORI PREDICTIVE METHODS OF ASSESSING HEALTH EFFECTS OF CHEMICALS IN THE ENVIRONMENT

M. J. Kland Oct. 1977 23 p refs Presented at the Conf. on Water Chlorination: Environ. Impact and Health Effects, Gatlinburg, Tenn., 31 Oct. 1977

(Contract W-7405-eng-48)

(LBL-6372; Conf-771070-4) Avail: NTIS HC A02/MF A01

Four techniques for assessing the multifactorial problems of toxicity and carcinogenicity of environmental pollutants are briefly described: structure/activity relationships (SAR), factor analysis (FA), pattern recognition (PR), and molecular connectivity (MC). While it is clear that none provides easy answers, it would appear that the more recent areas of PR and MC both merit more intensive investigation as predictive tools. In particular, the relative simplicity of the MC approach and the possibility of substantially reducing the empirical component are attractive incentives for pursuing further work in this area. ERA

N78-27634# Oak Ridge National Lab., Tenn. Environmental Sciences Div.

TRANSPORT AND TRANSFORMATION PATHWAYS OF HAZARDOUS CHEMICALS FROM SOLID WASTE DISPOSAL

R. I. VanHook 1977 49 p refs Presented at the 5th Life Sci. Symp., Los Alamos, N. Mex., Oct. 1977

(Contract W-7405-eng-26)

(CONF-7710114-1; Publ-1131) Avail: NTIS HC A03/MF A01

Disposal of solid wastes in both terrestrial and oceanic environments is considered. Atmospheric transport is considered for emissions from incineration of solid wastes and for wind resuspension of particulates from surface waste deposits. Solid wastes deposited in terrestrial environments are subject to leaching by surface and ground waters. Leachates may then be transported to other surface waters and drinking water acquifers through hydrologic transport. Leachates also interact with natural organic matter, clays, and microorganisms in soils and sediments. These interactions may render chemical constituents in leachates more or less mobile, possibly change chemical and physical forms and alter their biological activity. Oceanic waste disposal practices result in migration through diffusion and ocean currents. Surface area-to-volume ratios play a major role in the initial distributions of chemicals in the aquatic environment. Sediments serve as major sources and sinks of chemical contaminants. Food chaim transport in both aquatic and terrestrial environments results in the movement of hazardous chemicals from lower to higher positions in the food web. Bioconcentration is observed in both terrestrial and aquatic food chains with certain elements and synthetic organics. ERA

N78-27635# Energy Research and Development Administration, Washington, D. C. Div. of Operational and Environmental Safety.

ENVIRONMENTAL MONITORING AT MAJOR US ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION CONTRACTOR SITES: CALENDAR YEAR, 1976, VOLUME 1

Aug. 1977 779 p refs 2 Vol.

(ERDA-77-104/1-Vol-1) Avail: NTIS HC A99/MF A01

Individual annual reports are presented summarizing the result of the environmental monitoring programs conducted at each of the Energy Research and Development Administration sites having a potential for environmental impact or which release a significant quantity of radioactivity or nonradioactive pollutants. Data on the levels of radioactivity and nonradioactive pollutants in effluents and the environs at each site are given, and effluent and environmental measurements and sampling results are evaluated in relation to the appropriate standards for environmental protection, including estimates of potential radiation exposures offsite. In most cases the potential offsite exposures are so low they cannot be determined by direct measurement methods but must be estimated by calculational techniques. All potential offsite exposures to members of the public from routine effluent releases in 1976 were less than 5 mrem/yr (i.e., less than one percent of the established radiation protection guidelines for exposure of the public). ERA

N78-27636# Energy Research and Development Administration, Washington, D. C. Div. of Operational and Environmental Safety.

ENVIRONMENTAL MONITORING AT MAJOR US ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION CONTRACTOR SITES: CALENDAR YEAR 1976, VOLUME 2

Aug. 1977 738 p refs 2 Vol.

(ERDA-77-104/2-Vol-2) Avail: NTIS HC A99/MF A01

For abstract, see N78-27635.

N78-27637# Ames Lab., Iowa.

ENVIRONMENTAL EFFECTS OF BURNING SOLID WASTE AS FUEL

H. R. Shanks, J. L. Hall (Iowa State Univ., Ames), and A. W. Joensen (Iowa State Univ., Ames) 1977 6 p refs Presented at the 4th Joint Conf. on Sensing of Environ. Pollutants, New Orleans, 6 Nov. 1977

(Contract W-7405-eng-82)

(IS-M-124; Conf-771113-13) Avail: NTIS HC A02/MF A01

The city of Ames, Iowa, is burning processed solid waste as a supplemental fuel with coal in two traveling grate boilers

and one tangentially fired boiler at its municipal power plant. A complete environmental study of the facility is being conducted. Results are presented for one of the traveling grate boilers while burning various amounts of processed solid waste with high sulfur content Iowa coal. ERA

N78-27638# Drexel Univ., Philadelphia, Pa.
EFFECTS OF MESOSCALE WEATHER DISTURBANCES ON CONTAMINATION CONCENTRATIONS Technical Progress Report, 1 Aug. 1976 - 31 Oct. 1977
C. W. Kreitzberg Jul. 1977 83 p refs
(Contract EY-76-S-02-2360)
(COO-2360-5; TPR-4) Avail: NTIS HC A05/MF A01

The development and verification of a regional scale numerical weather prediction model for use in forecasting air pollution concentrations is presented. The scope includes verification of meteorological forecasts fo flow fields, boundary layer structure and precipitation using three hourly rawinsonde data in the central and eastern United States. A prototype regional numerical weather forecast system were developed. This system includes codes to read in the first guess data and the observational data needed to initialize the prediction model. Subsequent codes transform these analyses to the prediction gridn and adjust the wind field to remove the vertically integrated mass convergence. The output from that code is the input to the fine mesh prediction model that uses a 140 km grid size and makes a 24 h forecast. Fine mesh model output is used to initialize the mesoscale model and provide time dependent lateral boundary tendencies to the mesoscale model. The mesoscale model is on aa 35 km grid and normally makes a 12 h forecast. ERA

N78-27639# Oak Ridge National Lab., Tenn.
TRANSPORT AND TRANSFORMATIONS OF ANTHRACENE IN NATURAL WATERS: PROCESS RATE STUDIES
G. R. Southworth 1977 30 p refs Presented at Symp. on Aquatic Toxicology, Cleveland, 31 Oct. 1977
(Contract W-7405-eng-26)
(CONF-7710120-1) Avail: NTIS HC A03/MF A01

Anthracene was selected as a representative polycyclic aromatic hydrocarbon due to its intermediate molecular weight and its lack of carcinogenicity. Rates of photolysis, hydrolysis, volatilization, and microbial degradation of anthracene were measured under different environmental conditions using fluorimetric and radiotracer techniques. Equilibrium constants for processes such as sorption and bioaccumulation were also determined. ERA

N78-27640# Argonne National Lab., Ill.
SOME MICROMETEOROLOGICAL METHODS FOR MEASURING DRY DEPOSITION RATES
B. B. Hicks 1977 11 p refs Presented at 20th Ann. AICHE Meeting, N. Y., 13 Nov. 1977
(Contract W-31-109-eng-38)
(CONF-771102-21) Avail: NTIS HC A02/MF A01

Micrometeorological methods for the measurement of surface fluxes can be extended to the case of pollutant transfer in a way that eliminates the need to make assumptions about vertical diffusivities of surface properties. Instrumental requirements and some examples of experimental applications are given. Numerical simulations of the behavior of sulfur compounds emitted to the atmosphere as a result of industrial processes are cited as an example. ERA

N78-27641# Argonne National Lab., Ill.
DESIGN OF NETWORK EXPERIMENTS FOR REGIONAL-SCALE ATMOSPHERIC POLLUTANT TRANSPORT AND TRANSFORMATION
C. M. Sheih, G. D. Hess, and B. B. Hicks 1977 10 p refs Presented at the Joint Conf. on Appl. of Air Pollution Meteorol., Salt Lake City, 28 Nov. - 2 Dec. 1977; sponsored by the Am. Meteorol. Soc. and the Air Pollution Control Assoc.
(Contract W-31-109-eng-38)
(CONF-771118-4) Avail: NTIS HC A02/MF A01

In order to provide the information required to assess the effects of increasing the number of coal-burning power plants, several extensive research efforts, such as the Sulfur Transformation and Transport Experiment (STATE), the Sulfur Regional Experiment (SURE) and the Multistate Atmospheric Power Production Pollution Study (MAP3S), are currently being planned. The meaurements to be conducted in STATE and SURE are primarily air quality measurements, whereas many of the experiment proposed for MAP3S are parameterization studies addressing the physical and chemical governing mechanisms. Design criteria for the above two types of tracer experiments. The approach that will be followed is to examine the numerical models currently being developed by many investigators and then to deduce sampling criteria from theory and physical reasoning. For designing an air quality sampling network, the main criteria for locating sampling sites will be based upon the results of numerical simulation for the northeastern United States. ERA

N78-27642# Ohio State Univ., Columbus.
INTERNATIONAL CONFERENCE ON OXIDANTS, 1976: ANALYSIS OF EVIDENCE AND VIEWPOINTS. PART 3: THE ISSUE OF REACTIVITY Final Report
J. G. Calvert and H. E. Jeffries Oct. 1977 86 p refs Conf. held in Sep. 1976 Prepared in cooperation with North Carolina Univ., Chapel Hill
(Contracts EPA-DA-7-1804A; EPA-DA-7-2261J)
(PB-279009/5; EPA-600/3-77-114-Pt-2) Avail: NTIS HC A05/MF A01 CSCL 04A

The more than one hundred presentations and discussions at the Conference revealed the existence of several issues and prompted the EPA to sponsor a follow-up review/analysis effort. The follow-up effort was designed to review carefully and impartially, to analyze relevant evidence and viewpoints reported at the International Conference (and elsewhere), and to attempt to resolve some of the oxidant-related scientific issues. The review/analysis was conducted by experts (who did not work for the EPA or for industry) of widely recognized competence and experience in the area of photochemical pollution occurrence and control. GRA

N78-27643# State Univ. of New York at Albany.
INTERNATIONAL CONFERENCE ON OXIDANTS, 1976: ANALYSIS OF EVIDENCE AND VIEWPOINTS. PART 3: THE ISSUE OF STRATOSPHERIC ZONE INTRUSION Final Report
V. A. Mohnen and E. R. Reiter Dec. 1977 145 p refs Conf. held in Sep. 1976 Prepared in cooperation with Colorado State Univ., Fort Collins
(Contracts EPA-DA-7-1936A; EPA-DA-7-1305J)
(PB-279010/3; EPA-600/3-77-115-Pt-3) Avail: NTIS HC A07/MF A01 CSCL 04A

In recognition of the important and somewhat controversial nature of the oxidant control problem, the U.S. Environmental Protection Agency (EPA) organized and conducted a 5 day international conference in September 1976. The issue of stratospheric ozone intrusion, i.e., whether ozone of stratospheric origin contributes significantly to ground-level ozone buildup is discussed. The literature on the subject of ozone intrusion is discussed, and suggestions for further research to resolve some of the questions raised are made. GRA

N78-27644# PEDCO-Environmental Specialists, Inc., Cincinnati, Ohio.
SURVEY OF TECHNIQUES FOR MONITORING SEWAGE SLUDGE CHARGED TO MUNICIPAL SLUDGE INCINERATORS Final Report
Charles J. Sawyer Jun. 1977 88 p refs
(Contract EPA-68-02-1375)
(PB-279006/1; EPA-340/1-77-016a; Rept-3155-EE-6(3270-1-R)) Avail: NTIS HC A05/MF A01 CSCL 13B

New or modified sludge incinerators are regulated by the New Source Performance Standards; NSPS requires the installation of sludge feed monitoring devices to determine the amount of sludge charged to the incinerator. A survey of municipal incinerators in several EPA regions was conducted, to determine what is being done to conform with NSPS requirements. From these survey results, technical and cost information on sludge monitoring systems meeting NSPS requirements was compiled as a data base to guide regional offices and state agencies in their review and evaluation of feed monitoring devices. GRA

N78-27645# North Carolina Water Resources Research Inst., Raleigh. Dept. of Environmental Sciences and Engineering.
WATER QUALITY OF NORTH CAROLINA COASTAL PLAIN STREAMS AND EFFECTS OF CHANNELIZATION
Edward J. Kuenzler, Patrick J. Mulholland, Laura Anne Ruley, and Robert P. Sniffen Oct. 1977 181 p refs
(Contract DI-14-31-0001-5100)
(PB-278273/8; UNC-WRRI-77-127; W78-04707; OWRT-B-084-NC(2)) Avail: NTIS HC A09/MF A01 CSCL 13B

The physical and chemical characteristics of seven small coastal plain streams of eastern North Carolina were studied. Three natural streams which flow through relatively undisturbed bottomland hardwood forests were compared to four streams which had been channelized. Weighted mean concentrations of the nutrient elements N and P were much lower in waters of unpolluted natural streams than in rainwater, and there was a net input of these nutrients to the watershed. Concentrations and fluxes of elements such as Ca, Mg, Na, K, and Cl, however, were higher in all streams than in precipitation and the net fluxes of these elements were directed out of the watershed.
GRA

N78-27646# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
NATIONAL AIR QUALITY AND EMISSION TRENDS REPORT, 1976 Annual Report
W. F. Hunt, Jr., T. C. Curran, N. Frank, R. Faoro, and W. Cox Dec. 1977 70 p refs
(PB-279007/9; EPA-450/1-77-002) Avail: NTIS HC A04/MF A01 CSCL 13B

National and regional trends in air quality through 1976 are presented for total suspended particulate, sulfur dioxide, carbon monoxide, nitrogen dioxide and oxidants. The change in the number of people exposed to air quality levels above the National Ambient Air Quality Standards is emphasized for four major metropolitan areas: the New York-New Jersey-Connecticut Air Quality Control Region; the Los Angeles Basin; the city of Chicago and Metropolitan Denver. All areas show long-term improvement in reducting adverse pollution levels. A major feature of this report is the presentation of multi-color air quality maps for total suspended particulate, sulfur dioxide and photochemical oxidants.
GRA

N78-27647# Environmental Monitoring and Support Lab., Las Vegas, Nev.
OVERHEAD ENVIRONMENTAL MONITORING WITH LIGHT UTILITY AIRCRAFT: DEMONSTRATION AND EVALUATION OF THE SYSTEM
Gordon E. Howard, Jr. and Frank R. Wolle Jan. 1978 29 p refs
(PB-278748/9; EPA-600/4-78-008) Avail: NTIS HC A03/MF A01 CSCL 13B

The U.S. Environmental Protection Agency (EPA) is seeking to provide its 10 Regional Offices with a low cost remote sensing capability through development of a self contained sensor module called the Enviro-Pod (Pod). The design, development and manufacture of the prototype was accomplished by the U.S. Air Force Avionics Laboratory through an interagency agreement with the EPA. As presently configured, the Pod module contains two identical KA-85A panoramic cameras. One is mounted in the conventional vertical position and the second in an oblique position looking 45 degrees forward of the aircraft. The Pod has been successfully demonstrated in Washington, D.C., Boston, Atlanta, Philadelphia, and New York for EPA staff officials and personnel from eight other Federal agencies. Use of the Pod is foreseen in enforcement, compliance, episodic, and emergency monitoring activities. Results of feasibility demonstrations are summarized and a program is recommended for the production and suitability testing of the Pod module. Possible future sensor configurations for the Pod are also presented.
GRA

N78-27648# Kentucky Water Resources Research Inst., Lexington.
STUDIES ON THE ROLE OF SOLAR ULTRAVIOLET RADIATION IN NATURAL WATER PURIFICATION BY AQUATIC ECOSYSTEMS
John Calkins, Jeanne A. Barcelo, Perry Grigsby, and Stephan Martin Jan. 1978 101 p refs
(Contracts DI-14-34-0001-6018; DI-14-34-0001-7037; OWRT Proj. A-064-KY(2))
(PB-278666/3; RR-108; W78-05051) Avail: NTIS HC A06/MF A01 CSCL 13B

The possibility that pollution might deplete the stratospheric ozone layer and intensify solar UV at the earth's surface focuses attention on the role of solar UV in the various ecosystems at the earth's surface. Previous studies suggested that solar UV might contribute to bacterial die off in wastewater and the studies reported here were directed toward elucidating the action of solar UV in natural waters. It has been assumed that solar UV action on aquatic ecosystems can be evaluated (using proper models) on the basis of the following four independently measurable quantities: (1) the intensity of solar UV at the water surface, (2) the attenuation of the UV in the water column, (3) the position of the critical organism in the water, and (4) the sensitivity of the individual organisms to solar UV exposure. These four factors have been investigated on a continuing basis and the results of measurements have been utilized along with special field and laboratory experiments to assess UV-B actions.
GRA

N78-27649# Acurex Corp., Mountain View, Calif. Aerotherm Div.
ENVIRONMENTAL ASSESSMENT OF STATIONARY SOURCE NOx CONTROL TECHNOLOGIES Annual Report, Jun. 1976 - Jun. 1977
L. R. Waterland, H. B. Mason, R. M. Evans, K. G. Salvesen, and K. J. Wolfe Mar. 1978 109 p refs
(Contract EPA-68-02-2160; AEROTHERM Proj. 7241)
(PB-279083/0; AEROTHERM-TR-77-58; AR-1) Avail: NTIS HC A06/MF A01 CSCL 13B

Results of the first year of an environmental assessment program for stationary NOx combustion modification technologies are summarized. The first year effort concentrated on: (1) developing the methodology for environmental assessment and process engineering studies; (2) compiling data on source process characteristics, emissions, and pollutant impacts; and (3) setting program priorities on sources, controls, pollutants, and impacts. The report reviews each area and summarizes plans for future efforts. It discusses program results and plans for stationary NOx source equipment characterization, environmental goals compilation, source analysis model development, NOx control technology characterization, process engineering methodology development, baseline multimedia emissions inventory compilation, and systems analysis model development and use.
GRA

N78-27650# Battelle Columbus Labs., Ohio.
ENVIRONMENTAL QUALITY ASSESSMENT IN MULTIOBJECTIVE PLANNING Final Report, Aug. 1976 - Nov. 1977
K. M. Duke, N. Dee, D. C. Fahringer, B. G. Maiden, C. W. Moody, S. E. Pomeroy, and C. A. Watkins Nov. 1977 150 p refs
(Contract DI-6-07-DR-50150)
(PB-279219/0) Avail: NTIS HC A07/MF A01 CSCL 13B

A methodology for environmental quality assessments has been developed to implement the principles and standards developed by the Water Resources Council and Bureau of Reclamation Planning guidelines. A four level hierarchical structure for environmental quality account is described with 4 components, 15 categories, and 75 evaluation factors used to organize environmental measurements into a standard procedure for displaying the beneficial and adverse effects of water resource development projects on environmental quality. Examples of appropriate measurements for each evaluation category are provided along with suggested tables that might be used to display and summarize data used in the evaluation.
GRA

N78-27651# Southern Research Inst., Birmingham, Ala.
DEVELOPMENT AND LABORATORY EVALUATION OF A FIVE-STAGE CYCLONE SYSTEM Final Report, Apr. 1976 - Jun. 1977
Wallace B. Smith and Rufus Ray Jr. Wilson Jan. 1978 69 p refs
(Contract EPA-68-02-2131)

(PB-279084/8; SORI-EAS-78-44; EPA-600/7-78-008) Avail: NTIS HC A04/MF A01 CSCL 13B

The system was calibrated using both a vibrating-orifice aerosol generator (to generate mono-disperse, large-diameter dye particles for use at ambient and higher temperatures) and a pressurized Collision nebulizer (to disperse monodisperse, small-diameter latex particles for use at ambient temperature). Results from calibrating the cyclones at several conditions of flow, temperature, and particle density suggest that the D(50) cut points are proportional to the gas flow rate raised to a negative exponent which is between -0.63 and -1.11, linearly proportional to the gas viscosity, and proportional to the reciprocal of the square root of the particle density. At 25 C, 28.3 liters/min, and for a particle density of 1.0 g/cc, the D(50) cut points were 5.4, 2.1, 1.4, 0.65, and 0.32 micrometers. GRA

N78-27652# Texas A&M Univ., College Station. Dept. of Civil Engineering.

TECHNICAL AND PHILOSOPHICAL ASPECTS OF OCEAN DISPOSAL

Marchi C. Zapatka and Roy W. Hann, Jr. Nov. 1977 173 p refs

(Grant NOAA-04-6-158-44012)

(PB-279971/6; TAMU-SG-78-203; NOAA-78032002) Avail: NTIS HC A08/MF A01 CSCL 13B

Seven major technical aspects of ocean disposal are discussed. They include qualitative and quantitative aspects of waste materials, disposal methods, transport of materials through water, effects of wastes, legislation, regulations, critical quantities, disposal sites, alternatives to ocean disposal, and future trends of this disposal method. Twenty-two philosophies relating to ocean disposal are discussed, and relationships between technical aspects and philosophies are shown in figures. GRA

N78-27653# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Medical and Biological Effects of Environmental Pollutants.

HYDROGEN SULFIDE

Feb. 1978 281 p refs

(Contract EPA-68-02-1226)

(PB-278576/4; EPA-600/1-78-018) Avail: NTIS HC A13/MF A01 CSCL 06F

The scientific knowledge of hydrogen sulfide in the environment is reviewed. The occurrences, properties, and uses of hydrogen sulfide and the biogeochemical aspects of the sulfur cycle are discussed. Absorption, distribution, metabolism, and excretion of sulfide in animals and humans are considered. The odor of hydrogen sulfide is one of the most well-recognized characteristics of hydrogen sulfide; the psychological and aesthetic aspects of its odor are expounded. GRA

N78-27654# Laser Analytics, Inc., Lexington, Mass.

SPECTRAL MEASUREMENTS OF GASEOUS SULFURIC ACID USING TUNABLE DIODE LASERS Final Report, Nov. 1976 - Jul. 1977

Richard S. Eng, Kenneth W. Nill, and Jack F. Butler Feb. 1978 74 p refs

(Contract EPA-68-02-2482)

(PB-278985/7; EPA-600/2-78-019) Avail: NTIS HC A04/MF A01 CSCL 07D

Using a tunable diode laser spectrometer with a spectral resolution of about 10 to the -4 power/cm, the important central portions of the two infrared absorption bands of H2,SO4 at 8.2 micrometers and 11.3 micrometers were scanned at low pressure and at atmospheric nitrogen pressure. Maximum absorption coefficients were measured to be 6.5/cm/atm and 6.9/cm/atm at the 8.2 micrometer and 11.3 micrometer bands, respectively. Interference spectra of SO2, CO2, and H2O near the H2SO4 absorption peaks at 1222/cm and 880/cm were scanned using a 1.1 m cell at 200C to determine interference free regions. A spectroscopic method was used to measure the partial pressures of H2SO4, SO3, and H2O vapors above azeotropes of H2SO4 at 107 C, 150 C and 200 C. The expected performance characteristics of an H2SO4 tunable diode laser stack monitor are considered on the basis of the above results. GRA

N78-27655# Environmental Monitoring and Support Lab., Cincinnati Ohio

AN AUTOMATIC CHLORINATION SYSTEM FOR ELIMINATING BIOLOGICAL GROWTH IN PUMPING SYSTEMS FOR AUTOMATIC INSTRUMENTATION

Richard P. Lauch Jan. 1978 36 p refs

(PB-279081/4; EPA-600/4-78-010) Avail: NTIS HC A03/MF A01 CSCL 13B

Automatic chlorination was determined to be satisfactory for elimination of microbial growth (slime) in monitor pumping systems. With chlorination, changes in dissolved oxygen levels through the sampling system were minimized. Optimum chlorine concentration and frequency of chlorine addition to the system were determined during the period of maximum biological activity. GRA

N78-27656# Illinois Univ. at Urbana-Champaign, Savoy. Water Resources Center.

DYNAMICS OF MANGANESE, CADMIUM, AND LEAD IN EXPERIMENTAL POWER PLANT PONDS

B. J. Mathis, T. F. Cummings, Mary Gower, Michael Taylor, and Christine King Jun. 1977 69 p refs Prepared in cooperation with Bradley Univ., Peoria, Ill. Sponsored in part by Dept. of the Interior

(PB-279032/7; UILU-WRC-77-0125; W78-05480) Avail: NTIS HC A04/MF A01 CSCL 13B

This study was designed to determine the effect of heated power plant cooling water on the compartmentalization of manganese, lead and cadmium in experimental ponds. Caged channel catfish and green sunfish were kept in an experimental pond and a control pond. Periodically, whole fishes, gill, heart, kidney, liver and musculature were anlayzed for the three metals. Concentrations of the three metals in fishes were not affected by the temperature differential maintained during the study. There was no correlation in concentrations of cadmium and lead with age (weight and length) of fishes but manganese concentrations declined slightly with age. Aquatic organisms such as snails, fingernail clams, leeches, tubificid annelids and dragonfly nymphs exhibited concentrations of cadmium higher than sediments while snails and duckweed more closely reflected concentrations of manganese in sediments. GRA

N78-27657# Research Triangle Inst., Research Triangle Park, N. C.

ATMOSPHERIC CHEMISTRY OF POTENTIAL EMISSIONS FROM FUEL CONVERSION FACILITIES. A SMOG CHAMBER STUDY Final Report

J. E. Sickles, L. A. Ripperton, W. C. Eaton, and R. S. Wright Mar. 1978 260 p refs

(Contract EPA-68-02-2258)

(PB-278914/7; EPA-600/7-78-029) Avail: NTIS HC A12/MF A01 CSCL 13B

The atmospheric chemistry of chemical species that may be emitted from fuel conversion facilities were studied in smog chambers. Of 17 compounds assessed for ozone forming potential, 6 compounds were selected along with a control species, propylene, for testing in the presence of nitrogen oxides in four outdoor smog chambers. Selected compounds were furan, pyrole, thiophene, methanethiol, methyl sulfide, and methyl disulfide. Multiday exposures were performed, and both static and transport conditions were simulated. Ozone and sulfur dioxide formation was examined. The behavior of the test compounds was compared to that of a surrogate urban mix. GRA

N78-27658# Meteorology Research, Inc., Altadena, Calif.

AIRBORNE MONITORING OF COOLING TOWER EFFLUENTS. VOLUME 1: TECHNICAL SUMMARY Final Report

George J. Woffinden and Paul R. Harrison Apr. 1978 122 p refs Sponsored in part by EPRI and Maryland Dept. of Natural Resources

(Grant EPA-R-803969)

(PB-279076/4; EPA-600/7-78-079; EPRI-EA-420) Avail: NTIS HC A06/MF A01 CSCL 13A

Plume measurement included: temperature, dew point, visibility, turbulence, droplet size distribution and concentration, liquid water content, sodium chloride concentration, sulfuric acid concentration, sulfur dioxide concentration. Vertical cross sections

of the plume were mapped at several downwind distances. Data were recorded every half second to provide the short response times required for accurate plume profile measurements. The presence of stable visible plumes was observed during cold high humidity conditions. Even under these conditions, the decrease in visibility is not considered to be a hazard to aircraft because of the limited distance over which it extends. Interactions between the cooling tower plume and the boiler plume are limited. The boiler plume is saturated with water from combustion products and from a venturi wet scrubber. Therefore, chemical reactions that require moisture have occurred prior to mixing with the cooling tower plume, and the additional water supplied by the cooling tower plume has little effect. GRA

N78-27659# PEDCO-Environmental Specialists, Inc., Cincinnati, Ohio.
FLUE GAS DESULFURIZATION SYSTEM CAPABILITIES FOR COAL-FIRED STEAM GENERATORS. VOLUME 2: TECHNICAL REPORT Final Report, Apr. - Dec. 1977
T. Devitt, R. Gerstle, L. Gibbs, S. Hartman, and R. Klier Mar. 1978 514 p
(Contract EPA-68-02-2603)
(PB-279417/0; EPA-600/7-78-032b) Avail: NTIS HC A22/MF A01 CSCL 07A

The availability of technology for reducing SO2 emissions from coal-fired steam generators using flue gas desulfurization (FGD) systems is described. Foreign and domestic lime, limestone, double alkali, magnesium slurry, and Wellman-Lord FGD systems are described. The design parameters and operating experiences are discussed along with steps taken to achieve high system operability, disposal of FGD systems wastes. GRA

N78-27660# Monsanto Research Corp., Dayton, Ohio.
SOURCE ASSESSMENT. PESTICIDE MANUFACTURING AIR EMISSIONS: OVERVIEW AND PRIORITIZATION Final Report, Jul. 1976 - Jan. 1978
S. R. Archer, W. R. McCurley, and G. D. Rawlings Mar. 1978 153 p refs
(Contract EPA-68-02-1874)
(PB-279171/3; MRC-DA-766; EPA-600/2-78-004d) Avail: NTIS HC A08/MF A01 CSCL 07A

An overview is given of the pesticide manufacturing industry and gives priority to 80 major pesticides based on their potential environmental burden from an air pollution standpoint. Production of synthetic organic pesticides was about 640,000 metric tons in 1974. Thirty-seven major synthetic organic pesticides, those with annual production of 4540 or more tones, accounted for 74 percent of the market. Air pollution aspects of the pesticide manufacturing industry are essentially without quantitative data. For some plants, the pollution caused by loss of active ingredients is less significant than that caused by unreacted by-products. Emissions emanate from various pieces of equipment and enter the atmosphere as both the active ingredient and as raw materials, intermediates, and by-products. Air emission control devices include baghouses, cyclone separators, electrostatic precipitators, incinerators, and gas scrubbers. Synthetic organic pesticide production in 1985 will be about 806,000 metric tons. GRA

N78-27661# PEDCO-Environmental Specialists, Inc., Cincinnati, Ohio.
EFFECTS OF ALTERNATIVE NEW SOURCE PERFORMANCE STANDARDS ON FLUE GAS DESULFURIZATION SYSTEM SUPPLY AND DEMAND Final Report, Apr. - Dec. 1977
Vijay P. Patel and L. Gibbs Mar. 1978 114 p
(Contract EPA-68-02-2603)
(PB-279080/6; EPA-600/7-78-033) Avail: NTIS HC A06/MF A01 CSCL 07A

The capabilities of equipment vendors to supply and install the quantity of flue gas desulfurization systems required to meet alternative standards for coal-fired steam generators are discussed. It analyzes limiting factors affecting supply capabilities (such as the availability of components, equipment, and skilled labor). The quarantees that equipment vendors have made and are willing to make, and the penalities that they are willing to be assessed are also discussed. GRA

N78-27662# GEOMET, Inc., Gaithersburg, Md.
SURVEY OF INDOOR AIR QUALITY HEALTH CRITERIA AND STANDARDS
James E. McFadden, Howard J. Beard, III, and Demetrios J. Schandreas Mar. 1978 144 p refs Sponsored in part by HUD
(Contract EPA-68-02-2294)
(PB-278866/9; GEOMET-EF-595; EPA-600/7-78-027) Avail: NTIS HC A07/MF A01 CSCL 06E

Indoor air quality standards are classified into three types: (1) maximum allowable air quality standards; (2) design-level standards; and (3) emission standards. Both American and foreign efforts to issue standards in each of the types are discussed. The existing indoor air pollution standards and the health criteria documents on which they are based are enumerated. The major conclusion reached is that there was no scientific effort to establish air pollution standards specifically for the indoor nonworkplace environment. GRA

N78-27663# California State Dept. of Health, Berkeley. Air and Industrial Hygiene Lab.
CHARACTERIZATION OF ORGANIC PARTICULATE MATTER Final Report
B. R. Appel, E. M. Hoffer, M. Haik, S. M. Wall, E. L. Kothny, R. L. Knights (Washington Univ., Seattle), and J. J. Wesolowski Jul. 1977 199 p refs
(Contract ARB-5-682)
(PB-279209/1; CA/DO/AIHL/SP-9; ARB-R-5-682-77-72) Avail: NTIS HC A09/MF A01 CSCL 04A

A procedure for determining the concentrations of primary and secondary organics and elemental carbon in atmospheric aerosols is evaluated. A detailed characterization was provided for carbonaceous materials based on sampling conducted at three widely-spaced locations within California's South Coast Air Basin. The impact of the study's findings on control strategies for secondary organic aerosol formation was assessed. Employing a combination of selective solvent extraction and carbon analysis, a procedure was refined permitting analysis of two-hour particulate samples and, therefore, determination of diurnal variations of aerosol constituents. GRA

N78-27664# Pack (Donald H.), McLean, Va.
INTERNATIONAL CONFERENCE ON OXIDANTS, 1976: ANALYSIS OF EVIDENCE AND VIEWPOINTS. PART 5: THE ISSUE OF OXIDANT TRANSPORT Final Report
Donald H. Pack, Elmer Robinson (Washington State Univ., Pullman), and Fred Vukovich (Research Triangle Park, N. C.) Nov. 1977 74 p refs Conf. held Sep. 1976
(Contracts DA-7-1935A; DA-7-2085A; DA-7-21704H)
(PB-278750/5; EPA-600/3-77-117-Pt-5) Avail: NTIS HC A04/MF A01 CSCL 13B

A review/analysis was conducted on photochemical pollution occurrence and control. Included are discussions on the issue of oxidant transport, phenomena of urban plume formation and transport, measurement and tracking, and oxidants and precursor ranges. GRA

N78-27665# AeroVironment, Inc., Pasadena, Calif.
AIR QUALITY ANALYSIS OF THE SOUTHERN CALIFORNIA BIGHT IN RELATION TO POTENTIAL IMPACT OF OFF-SHORE OIL AND GAS DEVELOPMENT Final Report
Nov. 1977 458 p refs
(Contract DI-AA550-CT7-18)
(PB-279088/9; AV-FR-7112; BLM/ST-78-25) Avail: NTIS HC A20/MF A01 CSCL 21D

Air quality impacts of oil and gas development activities resulting from the proposed leasing of offshore tracts are assessed. Pertinent air quality laws, regulations, and standards are summarized. Considered are: quantifiable emissions of nonmethane hydrocarbons, nitrogen oxides, sulfur dioxide, carbon monoxide, and total suspended particulates. Photochemical (ozone) pollutants were also developed. Air quality levels were calculated through appropriate diffusion modeling within two defined scenarios: a most probable case of combined tanker/barge transport and pipelining; and a case in which all transport is conducted by tankering/barging. Additional impacts due to possible accidents such as spills and blowouts are modeled. GRA

N78-27666# WAPORA, Inc., New York. Northern Regional Office.
INSPECTION MANUAL FOR TOXIC AIR POLLUTANT EMISSIONS Final Report
Robert M. Cutler, Robert N. Rickles, James A. Rogers, and Thomas L. Sieger Aug. 1977 123 p refs
(Contract EPA-68-02-2555)
(PB-279090/5; EPA-903/9-77-028) Avail: NTIS HC A06/MF A01 CSCL 13B

Included in the manual are discussions of inspection authority, emission toxicity, emission sources, control techniques, unsteady operations, emission data, field investigations and a variety of inspection forms. These forms pertain to equipment as reactors, dryers, grinders, mills, storage tanks, pumps, compressors, hoods, ductwork, industrial waste incinerators and emission control devices. The manual also includes correlations for the estimation of emissions, dispersion, and toxicity (from lethal dosages - LD50's), and compilations of threshold limit values (TLV's), other Occupational Safety and Health Administration (OSHA) standards, known and potential carcinogens, odor descriptions and thresholds, vapor pressures, required air velocities for pollutant capture, safety and inspection equipment, toxic emission preliminary assessment procedures, and principal toxic emission references.
GRA

N78-27667# North Dakota State Dept. of Health, Bismarck.
ND-REAP AIR QUALITY NETWORK Final Report, May 1976 - Jul. 1977
Martin R. Schock and Jay Crawford Sep. 1977 72 p refs
(ND REAP Proj. 8-02-1)
(PB-278736/4; NDRR-78/02) Avail: NTIS HC A04/MF A01 CSCL 13B

The ambient air quality baseline/monitoring capabilities in southwestern North Dakota for protection of air quality in this area was expanded. Seven network sites were selected and equipped with air quality monitoring equipment and meteorological equipment. Data collected from these sites has increased the resolution of air dispersion qualities and provided necessary background information on air quality in an area where future energy development facilities are proposed. The additional data from the seven new sites, when used in conjunction with data from older sites, allows mapping of area-wide air quality for total suspended particulates in southwestern North Dakota. The even additional ambient air monitoring sites provided by this project have significantly increased the Department's capability to assess the impact of future energy conversion facilities on the ambient air quality.
GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N78-27668 Cornell Univ., Ithaca, N. Y.
ASPECTS OF THE LINEAR AND NONLINEAR DEVELOPMENT OF EQUATORIAL SPREAD F WITH APPLICATION TO IONOSPHERIC SCINTILLATION Ph.D. Thesis
Emanoel Paiva DeOliveiraCosta 1978 180 p
Avail: Univ. Microfilms Order No. 78-09472

A hybrid model for density irregularities is introduced which may be more physically meaningful in some wavelength regimes than the anisotropic power-law model previously proposed. Both of these irregularity models are constructed in a way consistent with in situ observations, and the weak scattering thin screen theory is applied in a mathematically rigorous way to obtain exact expressions for such parameters as the RMS fluctuation in the phase of wave front emerging from the irregularity region, the scintillation index S sub 4 (RMS fluctuation in the intensity of the received signal), and characteristic scales of scintillating spectrum. The theory is then applied to the results of density fluctuation measurements, obtained by a rocket probe during spread F occurrence.
Dissert. Abstr.

N78-27669 Washington Univ., Seattle.
AEROSOL PARTICLE SIZE AND SHAPE MEASUREMENTS THROUGH ASYMMETRIC LASER LIGHT SCATTERING Ph.D. Thesis
Jonathan Allen 1977 189 p
Avail: Univ. Microfilms Order No. 7807931

A light scattering aerosol particle counter was built around a low power helium-neon laser operating with a remote mirror in order to utilize as a scattering source the intense light within the standing wave cavity. As each particle of the hydrodynamically focused aerosol stream passes through the laser beam, two photomultipliers, one on each side of the sensing volume, detect the scattered light pulse. It was found that asymmetric scattering is a specific property of irregular shaped aerosols. Thus it was used to observe the deliquescent transition of sodium chloride, ammonium sulfate, and sea salt aerosols from crystalline form to solution droplets with rising humidity.
Dissert. Abstr.

N78-27670 Minnesota Univ., Minneapolis.
THE DETERMINATION OF FINITE STRAIN IN ROCKS: THE ROLE OF PRIMARY FABRIC Ph.D. Thesis
Timothy Bailey Holst 1977 256 p
Avail: Univ. Microfilms Order No. 7809676

Twenty-one samples of undeformed conglomerates, sandstones, tuffs, oolites, and pisolites from Precambrian to Recent in age were collected from a variety of geologic environments. Each sample was sectioned on three mutually perpendicular faces with one face parallel to bedding. Selected samples were also sectioned to 60 and 30 degrees to bedding. The shape and orientation of at least 100 particles were measured on each section. The Ramsay plot (1967), modified Ramsay plot (Dunnet, 1969), and the polar plot of Elliott (1970) were used in analyzing the fabrics. Particles range from nearly circular for some samples to quite eccentric ellipses for others. Sections parallel with bedding have essentially random fabrics (no preferred orientation). Sections not parallel with bedding have a preferred orientation along the bedding trace but particles with all orientations do exist.
Dissert. Abstr.

N78-27671 Loma Linda Univ., Calif.
MEGAFOSSIL ORIENTATION OF SELECTED SILURIAN, DEVONIAN, AND PLEISTOCENE REEFS ON NORTH AMERICA Ph.D. Thesis
Lance Thomas Hodges 1977 142 p
Avail: Univ. Microfilms Order No. 7809309

Eight study sites were used to investigate the nature of structures described as reef-related. Two sites were selected from the Pleistocene Key Largo Limestone of Florida, probably a backreef facies. The Florida sites were used as fossil reef reference sites, because of their close relationship to modern Florida reefs. The Devonian site at Ridgemount, Ontario, has bioherm and interreef facies. Silurian sites with bioherm facies were studied at Pekin, New York, and Maumee, Ohio. Silurian sites with flank facies were examined at Bluffton and Delphi, Indiana, and Rockford, Ohio. Orientation and several width and height measurements were made on each fossil. Colonial corals were used at all sites. Stromatoporoids were also used at Pekin.
Dissert. Abstr.

N78-27672 Stanford Univ., Calif.
GEOLOGY OF THE MONTEREY BAY REGION Ph.D. Thesis
Herbert Gary Greene 1978 484 p
Avail: Univ. Microfilms Order No. 7808793

Geophysical data and sea floor samples collected from the continental shelf and slope between Ano Nuevo Point and Point Sur, California indicate that the Monterey Bay region has had a complex late Cenozoic tectonic history. Uplift and depression have produced a succession of regressive and transgressive sedimentary units, while contemporaneous right-slip along faults of the San Andreas system have offset major structural and lithologic elements. This deformation produced three regional and several local unconformities within upper Tertiary rocks and initiated development of a canyon system that today includes the Monterey, Ascension, Carmel, and other large submarine canyons. An extensive erosional surface was cut during Zemorrian time into the late Mesozoic granitic basement rocks. Incised

into this surface are the ancestral Monterey Canyon and an unnamed canyon. Dissert. Abstr.

N78-27673 Colorado Univ., Boulder.
GEOLOGY OF EAST-CENTRAL ROCKY MOUNTAIN NATIONAL PARK AND VICINITY, WITH EMPHASIS ON THE EMPLOYMENT OF THE PRECAMBRIAN SILVER PLUME GRANITE IN THE LONGS PEAK - ST. VRAIN BATHOLITH Ph.D. Thesis
James Channing Cole 1977 393 p
Avail: Univ. Microfilms Order No. 7808885

Results of bedrock mapping in the Longs Peak Quadrangle, Colorado, and vicinity document the complex geologic history of the Precambrian rocks of the northern Front Range. The 1725 m.y.-old metamorphic complex represents the oldest rocks exposed in the area, and is dominated by quartzofeldspathic and aluminous schists, with minor amphibolitic and calcsilicate rocks. These were locally deformed (F2-F3) to produce sets of tight, asymmetrical megascopic folds on earlier (F1) isoclinal structures. The geometric character of F2-F3 structures, the alignment of minerals, and the common occurrence of phacolithic relict partial melts (migmatite leucosomes) in the hinge-regions of F2-F3 folds support the conclusion that this deformation was essentially contemporaneous with the thermal peak of major regional metamorphism in this area. Dissert. Abstr.

N78-27674 Stanford Univ., Calif.
PHASE EQUILIBRIA AND CRYSTALLIZATION IN IRON AND MAGNESIUM-BEARING GRANITIC SYSTEMS Ph.D. Thesis
Michael Terrance Naney 1978 244 p
Avail: Univ. Microfilms Order No. 7808818

In order to investigate the behavior of ferromagnesian components in granitic magmas, small amounts of iron and magnesium were added (in the form of an anhydrous biotite composition) to previously studied synthetic granite and granodiorite compositions in the systems $CaAl_2Si_2O_8$-$NaAlSi_3O_8$-$KAlSi_3O_8$-SiO_2. The resulting compositions model the average hornblende-biotite granite and hornblende-biotite granodiorite. Phase relations and crystal growth characteristics of these synthetic granitic compositions were investigated at pressures of 2 and 8 kilobars, and at temperatures ranging from 550 C to 1200 C. Textures developed in crystal growth experiments are analogous to some of those found in natural rocks. In addition, the textures also provide information on nucleation density as a function of undercooling for orthopyroxene, clinopyroxene, and hornblende. It was demonstrated that useful data on crystallization processes can be obtained in synthetic systems which approach the complexity of natural rocks. Dissert. Abstr.

N78-27675 Pennsylvania State Univ., University Park.
A GEOCHEMICAL STUDY OF THE INORGANIC CONSTITUENTS IN SOME LOW-RANK COALS Ph.D. Thesis
Robert Norman Miller 1977 319 p
Avail: Univ. Microfilms Order No. 78-08396

Vertical variations of the different forms of inorganic species in several lignites were studied. Four drill cores of lignites, including the roof, floor and major partings, from Alabama, Texas, and Wyoming were subdivided into small subsections for study. A channel sample of a North Dakota lignite was also included, and this was subjected to a gravity fractionation to obtain fractions of varying mineral content and composition. Total ash, sulfate, and pyrite were determined on all samples, and analyses were made for 30 elements on each section in the total ash, in certain extracts and in the isoluble residues, using instrumental techniques. To gain some understanding of how elements might be bound in a coal, the samples were put through a simple fractionation scheme to obtain three fractions as follows: (1) extract in 1.0 N ammonium acetate (pH 7.25 C) (2) extract in 1.0 N HCl (25 C) and (3) acid-insoluble residue.
Dissert. Abstr.

N78-27676 Florida State Univ., Tallahassee.
THE ATMOSPHERIC OXIDATION OF H2S AND THE OXYGEN ISOTOPIC RATIOS OF TROPOSPHERIC SULFATES Ph.D. Thesis
Mark Howard Thiemens 1977 207 p
Avail: Univ. Microfilms Order No. 7808975

The oxidation of hydrogen sulfide was investigated and a mechanism derived that leads to the formation of sulfur dioxide. The oxidation was initiated by the reaction of hydrogen sulfide with a hydroxyl radical forming on HS radical and water. The quantum yield for the formation of SO2 from H2S was unity with a calculated experimental error of 20%. By this mechanism, the residence time of H2S in the atmosphere was dependent upon the concentration of the OH radical and was approximately 17 hours. Aerosol sulfates were analyzed as a function of particle size for their oxygen isotopic content for the first time. Size separation of the sulfate appeared to be an effective means by which sea spray derived sulfate may be separated from sulfates from other sources. Dissert. Abstr

N78-27677 Wisconsin Univ. - Madison.
ELECTRICAL RESISTIVITY STRUCTURE OF THE CRUST IN THE SOUTHERN EXTENSION OF THE CANADIAN SHIELD Ph.D. Thesis
Ben Kollock Sternberg 1977 496 p
Avail: Univ. Microfilms Order No. 7804886

Electrical resistivity measurements on the southern extension of the Canadian Shield in northern Wisconsin show the presence of a large high conductivity anomaly in the crust. The Flambeau Anomaly is approximately 20 km wide, lies roughly along 46 N latitude, and extends east of 91 W longitude for more than 100 km. Detailed airborne electromagnetic surveys over parts of the anomaly show that the anomalous region consists of four to six roughly parallel conductive formations. Core samples from these formations indicate that graphite, sulfides, and iron formation are the principal conductive materials causing the anomaly. The model of the Flambeau Anomaly consists of five thin vertical half plane conductors. Numerical modeling indicates that the conductors extend to a depth of the order of 10 km. The Flambeau Anomaly appears to be a major structural feature in the southern extension of the Canadian Shield. Dissert. Abstr.

N78-27678 Pennsylvania State Univ., University Park.
RHEOLOGY AND STABILITY OF MINERAL SUSPENSIONS Ph.D. Thesis
Rabinder Singh Datta 1977 278 p
Avail: Univ. Microfilms Order No. 78-03387

The parameters influencing the stability of suspensions were determined experimentally. The influence of particle specific gravity, shape, size, size distribution, solids concentration, percentage of line material, suspension viscosity, chemical additives, and the interaction of these parameters was evaluated. The data were correlated so that a prediction can be made as to the rheological behavior of aqueous suspensions at low flow velocities based on a knowledge of the properties of the particulate matter under study. It is seen that extrapolation of the screen analysis for material greater than 400 mesh, to finer sizes, is not a dependable method for predicting the subsieve size distribution of a comminuted product. The Andreasen pipet and the sedigraph are very effective in determining the subsieve size analysis of a particulate assemblage. Dissert. Abstr

N78-27679 Colorado Univ. at Boulder.
QUATERNARY GEOMORPHOLOGY, GLACIAL CHRONOLOGY, AND CLIMATIC AND SEA-LEVEL HISTORY OF SOUTHWESTERN CUMBERLAND PENINSULA, BAFFIN ISLAND, NORTHWEST TERRITORIES, CANADA Ph.D. Thesis
Arthur Silas Dyke 1977 207 p
Avail: Univ. Microfilms Order No. 7808895

Morphostratigraphy, relative age-dating by weathering studies, radiocarbon and amino acid dating of raised marine strandlines, stratigraphic relations of end moraines to raised strandlines, and radiocarbon dating of buried soils reveal the sequence of events for the southwestern part of the peninsula. Radiocarbon dates on sea-level positions show that the Holocene marine limit is a synchronous strandline with a positive gradient beyond the Ranger glacial limit, but is a metachronous feature with a negative gradient behind the ice limit. Deleveling of shorelines in inner Cumberland Sound is much greater than was earlier shown and the zero isobase on net emergence during the Holocene is located ca. 110 km beyond the glacial limit. Dissert. Abstr.

N78-27680 Colorado Univ. at Boulder.
AGE DIFFERENTIATION OF TILL AND GRAVEL DEPOSITS IN THE UPPER COLORADO RIVER BASIN Ph.D. Thesis
Thomas Craig Meierding 1977 416 p
Avail: Univ. Microfilms Order No. 7808919

Detailed stratigraphic study and large amounts of data from relative age dating criteria demonstrate a complex Pleistocene glacial and fluvioglacial chronology for the Upper Colorado River Basin. Weathering criteria differentiate terrace gravels into a least six age groups. Many terraces can be traced to moraines: thus, terraces help to correlate tills from valley to valley within the study area. Pinedale and Bull Lake tills are strongly differentiated by relative dating criteria, and several subdivisions of each are weakly discerned. Three Pinedale and two Bull Lake readvances are also indicated in some localities where gravels have been overridden by tills. A tentative pre-Bull Lake till age assignment depends more on moraine position with respect to pre-Bull Lake terraces than on relative age dating criteria. Dissert. Abstr.

N78-27681 Texas Univ. at Austin.
RECONNAISSANCE GEOLOGY OF THE TOMOCHIC-OCAMPO AREA SIERRA MADRE OCCIDENTAL, CHIHAUHUA, MEXICO Ph.D. Thesis
Eric Rice Swanson 1977 154 p
Avail: Univ. Microfilms Order No. 7807393

The volcanic strata of two large remote areas near Tomochic and Ocampo in the Sierra Madre Occidental of western Chihuahua were mapped in a reconnaissance fashion utilizing remote sensing and a genetic approach to mapping which emphasizes caldera recognition. Most of the major units in the Sierran areas were sampled for chemical analysis and K-Ar dating as were some mafic lavas in the volcanic Basin and Range country to the east of the Sierra. Chemical data confirm that silicic volcanic rocks of the Sierra exhibit geographically related chemical variations. Volcanic rocks of inland Mexico tend to be higher in silicon and potassium but lower in sodium, calcium, and aluminum than are similar volcanic rocks closer to the coast. Volcanism in the Sierra is probably related to convergent motion and subduction of the Farallow plate 34 to 23 m.y. ago.
Dissert. Abstr.

N78-27682 Kansas Univ., Lawrence.
GEOLOGY AND MAMMALIAN PALEONTOLOGY OF THE OLIGOCENE-MIOCENE CABBAGE PATCH FORMATION, CENTRAL-WESTERN MONTANA Ph.D. Thesis
Donald Linden Rasmussen 1977 794 p
Avail: Univ. Microfilms Order No. 7809380

Comprehensive geological and paleontological investigations were conducted in four intermontane basins of central-western Montana from 1970 to 1974. Geologic, paleontologic, biostratigraphic, taphonomic, and paleoecologic determinations were used to substantially increase the knowledge of the Arikareean (land-mammal age) of North America. Correlation of the Cabbage Patch mammalian faunas exists to other contemporaneous Arikareean faunas in North America mainly on a generic level. A heavily vegetated mesic environment is indicated from the paleontologic and geologic determinations in this study.
Dissert. Abstr.

N78-27683 Idaho Univ., Moscow.
AN EVALUATION OF DIKE-FLOW CORRELATIONS INDICATED BY GEOCHEMISTRY, CHIEF JOSEPH SWARM, COLUMBIA RIVER BASALT Ph.D. Thesis
Susan Alys Medlicott Price 1977 343 p
Avail: Univ. Microfilms Order No. 78-08212

An initial assessment of chemical variation, based on the major, minor, and selected trace element analyses of 48 dikes of the Grande Ronde River-Joseph Creek area (formerly known as the Grande Ronde swarm), revealed that although intradike chemical variation is minimal, interdike chemical variation is significant. The dike-flow relations initially indicated by chemical similarity can be substantiated by direct or indirect field data, petrographic data, and paleomagnetic data. The results of the study indicate that comparative geochemistry is a reliable method for the correlation of dikes and proximate flows.
Dissert. Abstr.

N78-27684 Colorado State Univ., Fort Collins.
EXPERIMENTAL STUDY OF BASIN EVOLUTION AND ITS HYDROLOGIC IMPLICATIONS Ph.D. Thesis
Randolph Severn Parker 1977 351 p
Avail: Univ. Microfilms Order No. 7807435

A 30 by 50 ft facility was built and filled with a homogeneous mixture of sand, silt and clay. A sprinkling system provided four intensities of rainfall. The initial conditions (relief and initial surface slope) of each of two experiments were different. In the first experiment the network grew headward developing fully as it extended into the basin. In the second experiment an initial skeletal network blocked out much of the watershed, and later internal growth and rearrangement of channels occurred. Both experiments evolved through the sequence of network initiation, extension of the network to maximum extension which reflects the differences in the mode of growth. Dissert. Abstr.

N78-27685 Cornell Univ., Ithaca, N. Y.
STRUCTURAL GEOLOGY AND SEDIMENTOLOGY OF NIAS ISLAND, INDONESIA: A STUDY OF SUBDUCTION ZONE TECTONICS AND SEDIMENTATION Ph.D. Thesis
Gregory Frank Moore 1978 152 p
Avail: Univ. Microfilms Order No. 78-09501

The mid-Tertiary subduction complex exposed on Nias Island, Indonesia comprises tectonic melanges and slope basin sediments. The unique exposures on Nias allow the internal structures of subduction zone rocks to be observed in a known morpho-tectonic setting. Field mapping on Nas was undertaken in an attempt to gain insights into deformational and sedimentary processes occurring in subduction zones. Dissert. Abstr.

N78-27686 Stanford Univ., Calif.
SEDIMENTARY, DEFORMATIONAL, AND METAMORPHIC HISTORY OF FRANCISCAN CONGLOMERATES OF THE DIABLO RANGE, CALIFORNIA Ph.D. Thesis
Diane Elaine Moore 1978 277 p
Avail: Univ. Microfilms Order No. 78-08816

Major element chemical analyses of 18 igneous pebbles were made, using rock powder electron micorprobe techniques. The volcanic pebbles correspond to the calc-alkaline andesitic magma series developed in continental margin volcanic arcs, and the plutonic clasts are calc-alkaline rocks similar to those of the Sierra Nevada Batholith. The examined conglomerates are classified into Groups I, II, and III according to the differences in (1) degree and style of deformation; (2) degree of metamorphism; and (3) types of igneous detritus. Conglomerates from the same Group are associated geographically with each other and with graywacke blocks which have similar metamorphic and deformational characteristics. Dissert. Abstr.

N78-27687*# Denver Univ., Colo. Dept. of Physics.
THEORETICAL SIMULATION OF SOLAR SPECTRA IN THE MIDDLE ULTRAVIOLET AND VISIBLE FOR ATMOSPHERIC TRACE CONSTITUENT MEASUREMENTS Final Report, 15 Mar. 1977 - 15 Apr. 1978
A. Goldman 15 Apr. 1978 80 p refs
(Grant NsG-1405)
(NASA-CR-158903) Avail: NTIS HC A05/MF A01 CSCL 04A

Two balloon flights reaching float altitudes of approximately 30 and 40 km respectively, were used to obtain scans of the ultraviolet and visible solar spectra. Both flights covered the UV (2800-3500A) at approximately 0.3A resolution and the visible at approximately 0.6A. Numerous scans were obtained during ascent and from float for both flights. All spectral scans obtained at float, from high sun to low sun, were calibrated in wavelength by using several standard solar spectra for line position references. Comparisons of low sun scans and high sun scans show significant atmospheric continuum extinction and have the potential of being used to identify atmospheric lines superimposed on the attenuated solar spectrum. The resolution was mathematically degraded to approximately 5A to better see the broad band atmospheric extinction. This low resolution is also appropriate for the available low resolution absorption coefficients of NO2 and O3, allowing the identification of NO2 and O3 features on the sunset spectra. A.R.H.

N78-27688*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DYNAMICS OF EARTH AND PLANETARY ATMOSPHERES: A BRIEF ASSESSMENT OF OUR PRESENT UNDERSTANDING
C. B. Leovy and E. Suomi 1 May 1978 44 p Planetary Atmospheres Workshop, Snowmass, Colo., 10-16 Jul. 1977
(Contract NAS7-100)
(NASA-CR-157290; JPL-Pub-78-46) Avail: NTIS HC A03/MF A01 CSCL 04A

The present understanding of planetary atmospheres, the application of this knowledge to terrestrial problems, and the research needs in these overlapping areas are assessed. G.G.

N78-27689*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SAM-2 GROUND-TRUTH PLAN: CORRELATIVE MEASUREMENTS FOR THE STRATOSPHERIC AEROSOL MEASUREMENT-2 (SAM 2) SENSOR ON THE NIMBUS G SATELLITE
P. B. Russell (SRI International, Menlo Park, Calif.), M. P. McCormick, L. R. McMaster, T. J. Pepin (Wyoming Univ., Laramie), W. P. Chu (Systems and Applied Sciences Corp., Riverdale, Md.), and T. J. Swissler Jun. 1978 118 p refs
(NASA-TM-78747) Avail: NTIS HC A06/MF A01 CSCL 04A

The SAM-2 will fly aboard the Nimbus-G satellite for launch in the fall of 1978 and measure stratospheric vertical profiles of aerosol extinction in high latitude bands. The plan gives details of the location and times for the simultaneous satellite/correlative measurements for the nominal launch time, the rationale and choice of the correlative sensors, their characteristics and expected accuracies, and the conversion of their data to extinction profiles. The SAM-2 expected instrument performance and data inversion results are presented. Various atmospheric models representative of polar stratospheric aerosols are used in the SAM-2 and correlative sensor analyses. J.A.M.

N78-27690*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VERY LONG BASELINE INTERFEROMETRY APPLIED TO POLAR MOTION, RELATIVITY AND GEODESY Ph.D. Thesis - Maryland Univ.
Chopo Ma May 1978 387 p refs Sponsored by ARPA
(Contracts NAS7-100; NAS5-22843; Grants NsG-5035; NGR-22-009-839; Contract DI-14-08-001-14148; Grant NSF EAR-76-22615)
(NASA-TM-79582) Avail: NTIS HC A17/MF A01 CSCL 08F

The causes and effects of diurnal polar motion are described. An algorithm is developed for modeling the effects on very long baseline interferometry observables. Five years of radio-frequency very long baseline interferometry data from stations in Massachusetts, California, and Sweden are analyzed for diurnal polar motion. It is found that the effect is larger than predicted by McClure. Corrections to the standard nutation series caused by the deformability of the earth have a significant effect on the estimated diurnal polar motion scaling factor and the post-fit residual scatter. Simulations of high precision very long baseline interferometry experiments taking into account both measurement uncertainty and modeled errors are described. P.R.A.

N78-27691*# New York Univ., N. Y. Dept. of Applied Science.
A SCHEME FOR COMPUTING SURFACE LAYER TURBULENT FLUXES FROM MEAN FLOW SURFACE OBSERVATIONS
Martin I. Hoffert and Joel Storch (Brookhaven Natl. Lab.) Aug. 1978 34 p refs
(Grant NsG-5045)
(NASA-CR-157308; NYU/DAS-78/11) Avail: NTIS HC A03/MF A01 CSCL 04A

A physical model and computational scheme are developed for generating turbulent surface stress, sensible heat flux and humidity flux from mean velocity, temperature and humidity at some fixed height in the atmospheric surface layer, where conditions at this reference level are presumed known from observations or the evolving state of a numerical atmospheric circulation model. The method is based on coupling the Monin-Obukov surface layer similarity profiles which include buoyant stability effects on mean velocity, temperature and humidity to a force-restore formulation for the evolution of surface soil temperature to yield the local values of shear stress, heat flux and surface temperature. A self-contained formulation is presented including parameterizations for solar and infrared radiant fluxes at the surface. Additional parameters needed to impliment the scheme are the thermal heat capacity of the soil per unit surface area, surface aerodynamic roughness, latitude, solar declination, surface albedo, surface emissivity and atmospheric transmissivity to solar radiation. G.G.

N78-27692# Air Force Avionics Lab., Wright-Patterson AFB, Ohio. Electro-optics and Reconnaissance Branch.
METEOROLOGICAL SENSITIVITY OF LOWTRAN 3B Final Report, 1 Jul. - 1 Oct. 1971
Ronald R. Gruenzel Dec. 1977 36 p
(AF Proj. 2004)
(AD-A053840; AFAL-TR-77-229) Avail: NTIS HC A03/MF A01 CSCL 04/1

Mathematical expressions are developed which permit calculations of the meteorological sensitivity of Lowtran 3B, a computer code which can be used to calculate the transmittance of the atmosphere from the ultraviolet to the middle infrared portion of the spectrum. Mathematical relationships are developed which relate the water vapor line, uniformly mixed gases and ozone transmissions directly to the meteorological observables. These relationships are then used in conjunction with the existing expressions for the other atmospheric constituents to determine the meteorological sensitivity of this model. Author (GRA)

N78-27693# Naval Research Lab., Washington, D. C.
THE EFFECTS OF GEOMAGNETIC FIELD ALIGNED POTENTIAL DIFFERENCES ON PRECIPITATING MAGNETOSPHERIC PARTICLES Interim Report
Joseph H. Owens and Joel Fedder Jan. 1978 30 p
(AD-A053844; AD-E000141) Avail: NTIS HC A03/MF A01 CSCL 04/1

Mirroring of energetic ions and electrons between the magnetosphere and the ionosphere could by one possible mechanism for the precipitation of energetic particles necessary for the proper modeling of the auroral plasma. This paper considers the increased trapping or detrapping of particles in the ionosphere-magnetosphere mirror system caused by an electric potential difference along the geomagnetic field. It is found that the effect of this potential difference can be quite important to the proper modeling of the high latitude plasma, but is of lesser importance for the high energy Van Allen belts. Author (GRA)

N78-27694# Naval Research Lab., Washington, D. C.
SENSITIVITY ASSESSMENTS OF SOME DISTURBED E AND F REGION REACTION RATES Interim Report
A. Wahab Ali and Walter W. Jones Feb. 1978 36 p
(AD-A053846; AD-E000142) Avail: NTIS HC A03/MF A01 CSCL 04/1

Deionization calculations are carried out to assess the sensitivity of the electron density on several E and F regions reaction rate coefficients. Author (GRA)

N78-27695# California Univ., Livermore. Lawrence Livermore Lab.
SUBSURFACE STRUCTURE OF THE SOUTHERN PORTION OF THE SALTON SEA GEOTHERMAL FIELD
Marjorie A. Chan and John D. Tewhey 1 Nov. 1977 23 p refs
(Contract W-7405-eng-48)
(UCRL-52354) Avail: NTIS HC A02/MF A01

Subsurface correlation of sedimentary strata was attempted among ten geothermal wells in the southern portion of the Salton Sea Geothermal Field. The spontaneous potential (SP) log was the principal tool used for correlation purposes. The structure that emerges from the correlation diagrams is a shallow plunging syncline with an east-west axis perpendicular to the axis of the Salton Trough. ERA

N78-27696# National Meteorological Center, Washington, D. C.
THE LEM, LIMITED-AREA, FINE-MESH, MODEL, 1976: A DOCUMENTATION
Joseph F. Gerrity, Jr. Dec. 1977 78 p refs

(PB-279419/6; NOAA-TM-NWS-NMC-60; NOAA-78020601) Avail: NTIS HC A05/MF A01 CSCL 04B

The Limited-Area, Fine-Mesh model (LFM), used operationally at the National Meteorological Center is documented. Emphasis is placed upon the model's mathematical and physical approximations, and upon the methods used to initialize the model's sigma-coordinated variables from the analyzed fields. GRA

N78-27697# Technology Service Corp., Santa Monica, Calif.
EMPIRICAL RELATIONSHIPS BETWEEN ATMOSPHERIC NITROGEN DIOXIDE AND ITS PRECURSORS Final Report
John Trijonis Feb. 1978 365 p refs
(Contract EPA-68-02-2299)
(PB-278547/5; EPA-600/3-78-018) Avail: NTIS HC A16/MF A01 CSCL 04A

Aerometric data are examined to define relationships betweem atmospheric NO2 and its precursors. A descriptive and critical analysis of the nationwide data base of NO2 was carried out, followed by the formulation application and testing of empirical models relating ambinet NO2 changes to NOx and hydrocarbon (HC) emission controls. Results showed that: (1) other factors being constant, annual mean and yearly maximum NO2 are proportional to NOx input; (2) HC control yields slight-to-moderate reductions in yearly maximum NO2; (3) HC control yields essentially negligible benefits for annual mean NO2; and (4) the exact form of the NO2/precursor relationship may vary. GRA

N78-27698# Geological Survey, Tacoma, Wash.
THREE-DIMENSIONAL GEODETIC SURVEY ADJUSTMENT Interim Report
William G. Sikonia Nov. 1977 193 p
(PB-278660/6; USGS/WRD/WRI-78/017) Avail: NTIS HC A09/MF A01 CSCL 08D

This computer program adjusts the coordinates of survey stations to those which best fit the data in the least square sense. The computations can be done in two dimensions, adjusting in longitude and latitude, or in three dimensions, with the addition of height as an adjustable coordinate, or five dimensions, with the addition of deflection of the vertical in the parallel and meridian, or six dimensions with the addition of angle of refraction. A wide variety of survey measurements can be used as data, including horizontal directions, azimuths, distances, zenith distances, and astronomical observations. GRA

N78-27699# National Environmental Satellite Service, Washington, D. C. Meteorological Satellite Lab.
DETERMINATION OF THE EARTH-ATMOSPHERE RADIATION BUDGET FROM NOAA SATELLITE DATA
Arnold Gruber Nov. 1977 35 p refs
(PB-279633/2; NOAA-TR-NESS-76) Avail: NTIS HC A03/MF A01 CSCL 04A

The radiation budget was calculated using observations obtained by the two-channel scanning radiometer aboard NOAA operational satellites. The two channels observed reflected radiation in the visible range and emitted longwave radiation in the atmospheric window. The methods and approximations used in estimating the radiation budget from the operational data are described. Emphasis was placed on mean monthly zonal and global averages and annual maps of the radiation balance parameters, i.e., albedo, outgoing longwave radiation, absorbed radiation, and net radiation. The global albedo was calculated as 32.3% and the outgoing longwave radiation as 248 W/(m squared). GRA

N78-27466*# Texas Univ. at Austin. Dept. of Geological Sciences.
QUATERNARY GEOLOGY OF THE CHANNELED SCABLAND AND ADJACENT AREAS
Victor R. Baker *In its* The Channeled Scabland 1978 p 17-35 refs (For primary document see N78-27464 18-42)
Avail: NTIS HC A09/MF A01 CSCL 08G

N78-27467*# Geological Survey, Menlo Park, Calif.
BEDROCK GEOLOGY OF THE NORTHERN COLUMBIA PLATEAU AND ADJACENT AREAS
Donald A. Swanson and Thomas L. Wright (Geol. Surv., Reston, Va.) *In* Texas Univ. at Austin The Channeled Scabland 1978 p 37-57 refs (For primary document see N78-27464 18-42)
Avail: NTIS HC A09/MF A01 CSCL 08G

N78-27469*# Texas Univ. at Austin. Dept. of Geological Sciences.
LARGE-SCALE EROSIONAL AND DEPOSITIONAL FEATURES OF THE CHANNELED SCABLAND
Victor R. Baker *In its* The Channeled Scabland 1978 p 81-115 refs (For primary document see N78-27464 18-42)
Avail: NTIS HC A09/MF A01 CSCL 08G

N78-27470*# Wesleyan Univ., Middletown, Conn. Dept. of Earth and Environmental Sciences.
ORIGIN OF THE CHENEY-PALOUSE SCABLAND TRACT
Peter C. Patton and Victor R. Baker (Texas Univ. at Austin) *In* Texas Univ. at Austin The Channeled Scabland 1978 p 117-130 refs (For primary document see N78-27464 18-42)
Avail: NTIS HC A09/MF A01 CSCL 08G

N78-27471*# South Carolina Univ., Columbia. Dept. of Geology.
FIELD TRIP STOP DESCRIPTIONS
Dag Nummedal *In* Texas Univ. at Austin The Channeled Scabland 1978 p 131-168 refs (For primary document see N78-27464 18-42)
Avail: NTIS HC A09/MF A01 CSCL 08G

N78-27472*# South Carolina Univ., Columbia. Dept. of Geology.
AERIAL FIELD GUIDE
Dag Nummedal *In* Texas Univ. at Austin The Channeled Scabland 1978 p 169-177 refs (For primary document see N78-27464 18-42)
Avail: NTIS HC A09/MF A01 CSCL 08G

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N78-27700 Pennsylvania State Univ., University Park.
A NUMERICAL SIMULATION OF FOG DISSIPATION USING PASSIVE BURNER LINES Ph.D. Thesis
Paul Mark Tag 1977 166 p
Avail: Univ. Microfilms Order No. 78-08433

A two-dimensional model is used to simulate the distribution of heat from, and the response of a static fog to, passive line sources of heat positioned on the ground. A vorticity model, originally developed to simulate cumulus cloud development, is chosen as the starting point for the numerical work. Several important modifications and refinements are made to the model. A stretched grid is implemented for the vertical coordinate. A method for imparting an ambient crosswind is added and boundary conditions are changed to fit the requirements of this study. The successive over-relaxation technique for solving Poisson's equation is replaced by a direct solver. Variable eddy exchange coefficients replace the constant coefficients used in the original model. In addition, parameterizations to simulate the loss of heat to the soil, and simulate turbulent mixing of the thermodynamic parameters perpendicular to the model domain are developed. Dissert. Abstr.

N78-27701 Florida State Univ., Tallahassee.
LOW-LEVEL FEATURES OF TWO HIGH WIND SPEED REGIMES Ph.D. Thesis
Michael Stefan Moss 1977 162 p
Avail: Univ. Microfilms Order No. 7808964

Results from multilevel, low-layer aircraft investigations of 1975 Hurricanes Caroline and Eloise are presented. In both storms, straight horizontal legs paralleling the mean wind were flown at various heights between 85 and 1215 m above the sea surface. The length of the legs varied between 9.5 and 15 km. In Hurricane Caroline the experiment was adjacent to a rainband and in Eloise it was along the storm periphery. The mean vertical profiles for both storms show that in the lowest layers, potential

temperature and specific humidity do not vary with height. In Caroline the corresponding horizontal winds are not height invariant, whereas in Eloise they are. In both storms these regions are capped by a nearly isothermal layer. Also presented are results from detailed turbulence measurements obtained in Hurricane Eloise from a hot-film anemometer, a gust probe, and the conventional (one sample/second) aircraft instrumentation.
Dissert. Abstr.

N78-27702 Colorado State Univ., Fort Collins.
TROPICAL CYCLONE CLOUD AND INTENSITY RELATIONSHIPS Ph.D. Thesis
Charles Perry Arnold, Jr. 1977 170 p
Avail: Univ. Microfilms Order No. 78-07416

Results reveal a substantial variability exists in the cloudiness of tropical cyclones. This variability exists within a given storm, between similar stages of different storms, and even diurnally. As a corollary to this variability, only a weak relationship was found between vorticity and cloudiness. While the average or composited storm cloudiness changes little with storm stage, vorticity increases dramatically. There are obvious implications in this regard to cloudiness-storm intensity models. An examination of wind and thermodynamic characteristics support the findings from the satellite analysis. Mean storm stage vertical motions near the outflow level conform to the observed statistical trend in cloudiness. Dissert. Abstr.

N78-27703 Louisiana State Univ. and A&M Coll., Baton Rouge.
SEASONAL CHANGE IN THE MICROCLIMATES OF THE COLVILLE DELTA, ALASKA Ph.D. Thesis
Jeffrey S. Peake 1977 152 p
Avail: Univ. Microfilms Order No. 78-07553

The Colville Delta, 600 sq km in area, lies on the shore of the Beaufort Sea in the Coastal Plain Province of Northern Alaska. Between mid-April and mid-August, 1971, field studies were conducted. Examples of all delta environments except the delta front are present near the camp. The climatic characteristics of these environments were examined throughout the study period. They include: (1) the radiant energy between the surface and the atmosphere, (2) snow cover, (3) latent and sensible heat exchange, (4) surface thaw, and (5) the thermal state of the surface and near-surface environment. Dissert. Abstr.

N78-27704 Nebraska Univ. - Lincoln.
THE SIMULATION OF DRY SPELL FREQUENCIES Ph.D. Thesis
John Neddie Roy 1977 109 p
Avail: Univ. Microfilms Order No. 78-09163

The frequency of dry spells of length one to N months can be described by a mathematical curve. It was found that an inverse exponential curve of the form: Log Y = A - Bx; where Y is the number of dry spells of length X months and A and B are constants, accurately to fit the observed dry spell frequency distribution at most stations which were used in this study. From the equations a means of expressing the amount of dry spell persistence at a station was developed. Thirty-one stations, represented a variety of climatic types and average annual precipitation, were used to test the validity of the system generated dry spell frequency distribution. Findings from the study were compared to findings from geomorphological studies. A dry spell ratio, defined as the number of dry spells of order X divided by the number of dry spells of order X + 1, was calculated for each station. The dry spell ration is conceptually similar to the bifurcation ratio calculated for steams in a drainage basin. Like the bifurcation ratio, the dry spell ratio was found to cluster around specific values. Dissert. Abstr.

N78-27705*# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
STUDIES OF SATELLITE SUPPORT TO WEATHER MODIFICATION IN THE WESTERN US REGION Final Report, 15 Jun. 1974 - 17 Jan. 1978
W. R. Cotton, L. O. Grant, and T. H. VonderHaar Jan. 1978 125 p refs
(Grant NsG-5011)
(NASA-CR-156787) Avail: NTIS HC A06/MF A01 CSCL 04B

The applications of meteorological satellite data to both summer and winter weather modification programs are addressed. Appraisals of the capability of satellites to assess seedability, to provide real-time operational support, and to assist in the post-experiment analysis of a seeding experiment led to the incorporation of satellite observing systems as a major component in the Bureau of Reclamations weather modification activities. Satellite observations are an integral part of the South Park Area cumulus experiment (SPACE) which aims to formulate a quantitative hypothesis for enhancing precipitation from orographically induced summertime mesoscale convective systems (orogenic mesoscale systems). Progress is reported in using satellite observations to assist in classifying the important mesoscale systems, and in defining their frequency and coverage, and potential area of effect. Satellite studies of severe storms are also covered. A.R.H.

N78-27706*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
AN EVALUATION OF IN SITU OZONE SENSOR PERFORMANCE DURING A COLD FRONTAL PASSAGE
C. L. Parsons Jul. 1978 34 p refs
(NASA-TP-1239) Avail: NTIS HC A03/MF A01 CSCL 04B

The capabilities of the electrochemical concentration cell ozonesonde for measuring the vertical profile of atmospheric ozone were studied during a three day experiment at Wallops Island, Virginia, and Norfolk, Virginia. Using ancillary measurements at the surface and the spectrophotometer, it was concluded that the ozonesonde measures the total ozone overburden to within 10% of the real value. By releasing the balloon-borne instruments at a rate of four per day at each of the two sites, an indication was obtained of the temporal and spatial scales of atmospheric ozone variability. No significant effects of a weak cold front passage or of the loss of insolation at night were seen. An isolated incident of anomalously high ozone concentration at the peak of the profile was attributed to sporadic instrument performance effects. The data base currently available is not adequate for determining an exact cause of the anomaly. G.Y.

N78-27707# National Oceanic and Atmospheric Administration, Boulder, Colo. Air Resources Labs.
DEPENDENCE OF ATMOSPHERIC TURBIDITY AT RALEIGH, N. C. ON AIR MASS TRAJECTORIES
Guillermo J. Berri and James T. Peterson Feb. 1978 21 p refs
(PB-279989/8; NOAA-TM-ERL-ARL-68; NOAA-78030303) Avail: NTIS HC A02/MF A01 CSCL 04B

The dependence of atmospheric turbidity on air mass trajectories is analyzed. Observations were taken at Raleigh, N. C., with an EPA/NOAA dual-wavelength sunphotometer. Turbidity is greater, by a factor 2, for maritime tropical than for continental polar air masses. For each of these air mass types there is a factor of 3 between summer and winter turbidities, with largest values in summer. Turbidity increases as the air mass increases its travel time over the continental U.S. Angstrom's wavelength exponent is also analyzed, and the most significant differences are found in summer, between maritime tropical and continental polar air masses. GRA

N78-27708# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
INFRARED PASSIVE WIND SENSING: A FEASIBILITY STUDY
G. R. Ochs and Ting-i Wang Oct. 1977 17 p
(PB-280080/3; NOAA-TM-ERL-WPL-34; NOAA-78030701; ECOM-77-10) Avail: NTIS HC A02/MF A01 CSCL 04B

The feasibility of measuring crosswinds by observing the scintillation of the natural background radiation in the wavelength region from 8 to 12 micrometers was analyzed. Methods of signal analysis and experimental results for visual wavelengths are discussed. A signal to noise analysis and experimental results indicate that an infrared system is marginally possible, with singal to noise ratios approximately two orders of magnitude below that of a visual system. GRA

N78-27709# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
AN INTERPRETATIVE REVIEW OF EXISTING CAPABILITIES FOR MEASURING AND FORECASTING SELECTED WEATH-

ER VARIABLES (EMPHASIZING REMOTE MEANS)
H. H. Monahan and R. M. Cionco Jan. 1978 57 p refs
(DA Proj. 1L1-61102-B-53A)
(AD-A053854; ERADCOM/ASL-TR-0001) Avail: NTIS HC A04/MF A01 CSCL 04/2

The variability in weather many times influences significantly the decisions made in military tactical planning and operations affecting the utilization of Army weapons systems, smoke deployment for both offensive and defensive purposes, and air and ground operations. An interpretative review has been made of many documented capabilities for measuring and forecasting selected weather variables, i.e., precipitation, cloud cover and height, and profiles of temperature, humidity, and wind speed, that exist worldwide. Methodologies and techniques that rely on the collection of meteorological data by remote means and numerical prediction models that are operational have been emphasized. Available evaluation information is presented for some of the methodologies and techniques included in the report.
Author (GRA)

N78-27710# International Institute for Applied Systems Analysis, Laxenburg (Austria).
FURTHER STUDIES OF THE IMPACT OF WASTE HEAT RELEASE ON STIMULATED GLOBAL CLIMATE, PART 2
J. Williams, G. Kroemer, and A. Gilchrist (Meteorological Office, Bracknell, England) Jun. 1977 40 p refs
(RM-77-34-Pt-2) Avail: NTIS (US Sales Only) HC A03/MF A01; DoE Depository Libraries

A general circulation model was used to investigate the impact of an input of waste heat into the atmosphere. Although the total heat input was the same as in a previous experiment, the different locations of the heat islands caused a different response in the various climatic variables. It also can be said that EX04, in general, produced smaller changes than the previous experiments. They are, however, still significant. Temperature and wind at sigma level 0.5 have been considered for all experiments as this has not previously been done for any of the experiments. A new attempt was undertaken to assess the model variability by using 10-day means instead of 40-day means for calculating the standard deviation of the control cases. The signal to noise ratios were recalculated, and a much smoother distribution was obtained. ERA

N78-27711# Brookhaven National Lab., Upton, N. Y.
MEASUREMENT OF VERTICAL VELOCITY FLUCTUATIONS IN THE ATMOSPHERIC BOUNDARY LAYER WITH A SMALL AIRCRAFT
S. SethuRaman, R. M. Brown, G. S. Raynor, and W. A. Tuthill 1978 3 p Presented at 4th Symp. on Meteorol. Observations and Instrumentation, Denver, Colo., 10 Apr. 1978
(Contract EY-76-C-02-0016)
(BNL-23633; Conf-780412-3) Avail: NTIS HC A02/MF A01

Turbulence in the atmospheric boundary layer is one of the parameters that varies with height and depends on several factors, atmospheric stability, terrain, wind speed, etc. Measurement by aircraft is one of the methods of studying the variation of turbulence at higher elevations in the boundary layer. Sensors mounted on the aircraft are used to measure high frequency velocity fluctuations. The use of a simple device called a variometer to measure vertical velocity fluctuations in the atmospheric boundary layer is described. The method consists of flying the variometer in a small aircraft and allowing the aircraft to be controlled by the atmospheric eddies in the vertical plane while maintaining control over the general direction of flight. ERA

N78-27712# Brookhaven National Lab., Upton, N. Y.
SOME MICRO-METEOROLOGICAL OBSERVATIONS DURING THE APPROACH AND PASSAGE OF HURRICANE BELLE (1976)
S. SethuRaman 1977 4 p Presented at 11th Conf. on Hurricanes and Tropical Meteorol.
(Contract EY-76-C-02-0016)
(BNL-23638; Conf-771227-1) Avail: NTIS HC A02/MF A01

Storm track of Hurricane Belle indicates a near-northerly movement at a rate of about 20 miles per hour. A series of satellite pictures was taken on August 9 and 10. An understanding of the microstructure of severe storms like hurricanes in the surface layer is important due to a variety of applications; design of buildings and structures, prediction of damages, evacuation of people, etc. The study of the structure of hurricanes within the first 100 m over water gets logistically difficult due to the rough seas and lack of stable platforms. The environmental data buoys operated by NOAA monitor the mean quantities of the storm as its passes by, and the National Hurricane Laboratory of NOAA studies the higher altitudes of hurricanes with aircrafts. The structure of turbulence in the atmospheric surface layer and the variation of wind across the island as the hurricane approached and then moved over Long Island is discussed. ERA

N78-27713# Oak Ridge National Lab., Tenn.
MONTE CARLO SIMULATION OF TURBULENT ATMOSPHERIC TRANSPORT: COMPARISON WITH EXPERIMENTAL DATA
R. G. Alsmiller, Jr., F. S. Alsmiller, H. W. Bertini, and C. L. Begovich 1977 6 p Presented at ANS Winter Meeting, San Francisco, Calif., 27 Nov. 1977
(Contract W-7405-eng-26)
(CONF-771109-58) Avail: NTIS HC A02/MF A01

The Monte Carlo computer code SPOOR permits simple trajectories of individual tracer particles in the atmosphere to be followed. As originally formulated, SPOOR provided the motion of the centroid of a puff of airborne tracers released instantaneously from a fixed source and the time evolution of the puff shape. SPOOR was modified to allow for continuous particle emission from a smoke stack. Comparisons were made with experimental data. ERA

N78-27714# Drexel Univ., Philadelphia, Pa.
PROGRESS AND PROBLEMS IN REGIONAL NUMERICAL WEATHER PREDICTION
C. W. Kreitzberg 1977 28 p Presented at Symp. on Computational Fluid Mechanics, New York City, 16 Apr. 1977
(Contract EY-76-S-02-2360)
(COO-2360-4; Conf-77043-1) Avail: NTIS HC A03/MF A01

The status of research and development on numerical weather prediction at a new (smaller) scale is reviewed. This regional scale uses a horizontal mesh size of about 35 kM over a horizontal domain size of about 1700 kM squared. The model forecasts weather, including clouds and stratiform (steady) and cumulus (showery) precipitation out to 24 h beyond the lastest observation time. The principal gains are expected to be in the accuracy and detail of precipitation forecasts and cloudiness forecasts, including the effects of terrain and (parameterized) cumulus convection. The principal problem area is the development of techniques to incorporate into the preceding forecast, more recent, detailed observations from surface-based and satellite observations. Statistical treatment of model output, expression of predictions in statistical terms, and meaningful verification measures are all very important to an effective forecast system. ERA

N78-27715# Chicago Univ., Ill. Lab. for Atmospheric Probing.
PART 1: TIME-DOMAIN COMPUTATION OF MEAN AND VARIANCE OF DOPPLER SPECTRA. 2. ESTIMATION OF THE CONTRIBUTION OF ATTENUATION TO THE RATIO OF 10 TO 3 CM POWERS Final Report
R. C. Srivastava, A. R. Jameson, and P. H. Hildebrand (Illinois State Water Survey, Urbana) 1 Dec. 1977 14 p refs
(Grant NOAA-04-022-44018)
(PB-279026/9; NOAA-78021607) Avail: NTIS HC A02/MF A01 CSCL 04B

Doppler spectra which were observed in a situation of artificially injected chaff and in a thunderstorm situation were used to compute the following parameters: (1) the true mean and variance of the meteorologically significant component of the Doppler spectra, (2) the pulse pair mean of the spectra, (3) the pulse pair variance of the spectra with and without correction for the noise, and (4) the signal to noise ratios and variances of Doppler spectra using new algorithms. A technique was developed for estimation, attenuation, and ratio of the reflectivities at 10 cm and 3 cm wavelengths. The technique utilizes certain properties of signal fluctuations and attenuation to derive the attenuation by performing piecewise linear least squares fits to the logarithms of the ratio of the powers measured at the two wavelengths along a single radial. In addition, the ratio of the reflectivities,

determined from the measured powers and estimated attenuation, was used to diagnose the occurrence and size of hail. P.R.A.

N78-27716# National Oceanic and Atmospheric Administration, Washington, D. C.
NATIONAL SEVERE LOCAL STORMS OPERATIONS PLAN Annual Report
Jan. 1978 50 p Revised
(PB-279632/4; NOAA-S/T-78-114; AR-11; NOAA-78021004; FCM-78-1-Rev) Avail: NTIS HC A03/MF A01 CSCL 04B

The responsibilities of the various United States agencies are outlined which provide meteorological services in observing and forecasting severe local storms. GRA

N78-27717# National Weather Service, Fort Worth, Tex. Southern Region
A COMPARISON OF PROBABILITY OF PRECIPITATION FORECASTS AND RADAR ESTIMATES OF RAINFALL AREAL COVERAGE
Daniel L. Smith (National Weather Service Forecast Office, Birmingham, Ala.) and Matthew Smith (National Weather Service Forecast Office, Birmingham, Ala.) Feb. 1978 21 p
(PB-279987/2; NOAA-TM-NWS-SR-96; NOAA-78032012) Avail: NTIS HC A02/MF A01 CSCL 04B

An investigation of summertime rainfall in southern Alabama and northwest Florida is continued. Data from the summer of 1977 was tabulated and are presented for comparison with those from the summer of 1976. Analysis of summertime rainfall (echo) coverage and coincident forecast PoPs yielded several important results. Areal coverage of rainfall can be accurately determined from an analysis of hourly radar data. Areal coverage of rainfall in the zones of southern Alabama and northwest Florida on summer days is just as likely to be 20% as 100%. GRA

N78-27718# National Weather Service, Kansas City, Mo. Central Region.
A PROGRAM OF CHART ANALYSIS, (WITH SOME DIAGNOSTIC AND FORECAST IMPLICATIONS)
Lawrence A. Hughes Dec. 1977 106 p
(PB-279866/8; NOAA-TM-NWS-CR-63; NOAA-78030803) Avail: NTIS HC A06/MF A01 CSCL 04B

A minimum program of chart analysis recommended for all Central Region offices making forecasts is discussed in compact form. The program brings out the main features of interest to most forecast problems and it will serve in the briefing of the next forecast shift. The program is aimed at WSFOs, but is appropriate for WSOs for whatever charts are posted for use. It treats Facsimile and Request/reply (R/R) material. The analyses are intended to be functional, not decorative, and thus should be made primarily for the area of interest, which would be mainly in the upstream or potential upstream direction and for a distance appropriate to the area and time periods of responsibility. GRA

N78-27719# National Weather Service, Salt Lake City, Utah.
CLIMATE OF SAN FRANCISCO
E. Jan Null (National Weather Service Forecast Office, San Francisco) Feb. 1978 45 p refs
(PB-279975/7; NOAA-TM-NWS-WR-126; NOAA-78030203) Avail: NTIS HC A03/MF A01 CSCL 04B

An overview, both subjectively and numerically, is provided of the climate of San Francisco. It is a compilation of data archived at San Francisco spanning a 125-year period and is primarily an attempt to bring together under one cover as much of this data as possible. The primary influence upon San Francisco's weather, being in the mid-latitude westerlies, is the proximity of a large body of water to the west (the Pacific Ocean). The resulting climate is characterized as Mediterranean (Etesian). This is a climate which is mild and temperate with dry summers and wet winters. Also a contributing factor is the topography of San Francisco, with hills dividing the city into numerous microclimates; the most pronounced differences being the often foggy coastal section compared to the sunnier sections east of the hills. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N78-27720 South Carolina Univ., Columbia.
VARIATIONS IN TIDAL INLET PROCESSES AND MORPHOLOGY IN THE GEORGIA EMBAYMENT Ph.D. Thesis
Dennis Keith Hubbard 1977 90 p
Avail: Univ. Microfilms Order No. 7807907

Large scale sand body distributions were determined by aerial reconnaissance and inspection of oblique and vertical aerial photographs. The distribution of surface bedforms and internal sedimentary structures were determined through low tide ground reconnaissance, SCUBA observations, fathometer profiles, trenches and box cores. Based on these studies, three types of inlets were identified: tide dominated, wave dominated, and transitional. Dissert. Abstr.

N78-27721 Columbia Univ., New York.
STUDIES OF DEEP-SEA SEDIMENTATION PROCESSES USING HIGH FREQUENCY SEISMIC DATA. PART 1: LITHOLOGIC AND TOPOGRAPHIC INFLUENCES ON BOTTOM AND SUBBOTTOM REFLECTIVITY IN DEEP OCEAN ENVIRONMENTS. PART 2: PLEISTOCENE AND RECENT SEDIMENTATION PROCESSES OF THE NORTHWEST AFRICAN CONTINENTAL MARGIN AND CANARY BASIN Ph.D. Thesis
Robert Wayne Embley 1976 350 p
Avail: Univ. Microfilms Order No. 78-04359

A selected survey of comparisons between lithology, sound velocity, wet density, and porosity variations in piston cores with subbottom reflections recorded at 3.5 kHz is presented. In a proximal turbidite facies, the reflectors are due to the basal silt and sand layers, and both sound velocity and density changes contribute to the impedance changes. In a distal turbidite facies, the reflectors are due either to silt layers or to changes between the pelagic lithologies and the more rapidly deposited turbidite or hemipelagic clays. Piston cores, 3.5 kHz echograms, and bottom photographs were used to examine Pleistocene and recent sedimentation processes and sediment dispersal paths in the Canary Basin between 23 deg - 35 deg N and 13 deg - 28 deg W. An acoustic map based on all available 3.5 kHz echograms shows the regional variation in signal penetration, echo character (e.g., prolonged echo), and microtopography. Smooth or gently undulating seafloor with continuous subbottoms and 20-60 m of signal penetration is observed over most of the continental rise and basin of this area. Dissert. Abstr.

N78-27722 Boston Univ., Mass.
SPACE-TIME SEDIMENT RELATIONSHIPS IN THE NEARSHORE ZONE: THE CASE OF STORM CONDITIONS Ph.D. Thesis
Jay Edward Leonard 1978 557 p
Avail: Univ. Microfilms Order No. 7808036

During late October of 1975 an array of electronic sensors was installed on Nauset Light Beach, Cape Cod, Massachusetts, in order to provide a description of the sediment movement during storm conditions. Results of the experiment indicate the following: (1) the classical dynamic zone model used by most coastal workers is inappropriate for severe conditions; (2) during storm conditions there is significantly more sediment movement normal to the shoreline (onshore/offshore) than parallel (longshore); (3) instantaneous sand suspension clouds are more common throughout the rising tidal cycle in storm conditions than in non-storm conditions; (4) these instantaneous sand suspension clouds are not distributed uniformly through space and time; (5) transport of sediment occurs at a higher frequency during storm events, although the major changes in sediment elevation still occur at lower frequencies. Dissert. Abstr.

N78-27723 Case Western Reserve Univ., Cleveland, Ohio.
A PALEOCLIMATIC STUDY OF THREE SOUTHERN OCEAN DEEP-SEA CORES Ph.D. Thesis
Douglas Brent Welker 1978 325 p
Avail: Univ. Microfilms Order No. 7809303

Three U.S.N.S. Eltanin cores, 47-3, 47-38, and 47-11, taken

from approximately 2700m on a small plateau south of the Kerguelen Plateau at approximately 63 degrees S, were studied in an effort to determine glacial-interglacial changes in sea water delta O(18) during portions of the past 900,000 years. These cores were used because, in spite of the complex nature of the cores and of the oceanography in that area, little glacial-interglacial water temperature change was expected at the core sites. These cores show that a minimum of three or four major climatic cycles have taken place during the past 900,000 years, an observation consistent with studies of other cores from the Southern Ocean. Dissert. Abstr.

N78-27724*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DETERMINATION OF SOME DOMINANT PARAMETERS OF THE GLOBAL DYNAMIC SEA SURFACE TOPOGRAPHY FROM GEOS-3 ALTIMETRY
R. S. Mather, F. J. Lerch, C. Rizos (Johns Hopkins Univ., Baltimore, Md.), E. G. Masters (Johns Hopkins Univ., Baltimore, Md.), and B. Hirsch (Johns Hopkins Univ., Baltimore, Md.) May 1978 46 p refs Presented at 2d Intern. Symp. on the Use of Artificial Satellites for Geodesy and Geodynamics, Lagonissi, Greece, 29 May - 3 Jun. 1978 Submitted for publication
(NASA-TM-79558) Avail: NTIS HC A03/MF A01 CSCL 08J

The 1977 altimetry data bank is analyzed for the geometrical shape of the sea surface expressed as surface spherical harmonics after referral to the higher reference model defined by GEM 9. The resulting determination is expressed as quasi-stationary dynamic SST. Solutions are obtained from different sets of long arcs in the GEOS-3 altimeter data bank as well as from sub-sets related to the September 1975 and March 1976 equinoxes assembled with a view to minimizing seasonal effects. The results are compared with equivalent parameters obtained from the hydrostatic analysis of sporadic temperature, pressure and salinity measurements of the oceans and the known major steady state current systems with comparable wavelengths. The most clearly defined parameter (the zonal harmonic of degree 2) is obtained with an uncertainty of + or - 6 cm. The preferred numerical value is smaller than the oceanographic value due to the effect of the correction for the permanent earth tide. Similar precision is achieved for the zonal harmonic of degree 3. The precision obtained for the fourth degree zonal harmonic reflects more closely the accuracy expected from the level of noise in the orbital solutions. G.G.

N78-27725*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE ANALYSIS OF TEMPORAL VARIATIONS IN REGIONAL MODELS OF THE SARGASSO SEA FROM GEOS-3 ALTIMETRY Technical Memorandum, Jul. 1975 - Aug. 1976
R. S. Mather, R. Coleman (Johns Hopkins Univ., Baltimore, Md.), and B. Hirsch (Johns Hopkins Univ., Baltimore, Md.) May 1978 58 p refs Presented at the 2d Intern. Symp. on The Use of Artificial Satellites for Geodesy and Geodynamics, Lagonissi, Greece, 29 May - 3 Jun. 1978
(Grant NsG-5225)
(NASA-TM-79549) Avail: NTIS HC A04/MF A01 CSCL 08C

The dense coverage of short pulse mode GEOS-3 altimeter data in the western North Atlantic provides a basis for studying time variations in the sea surface heights in the Sargasso Sea. Two techniques are utilized: the method of regional models, and the analysis of overlapping passes. An 88 percent correlation is obtained between the location of cyclonic eddies obtained from infrared imagery and sea surface height minima in the altimeter models. This figure drops to 59 percent in the case of correlations with maxima and minima of surface temperature fields. The analysis of overlapping passes provides a better picture of instantaneous sea state through wavelengths greater than 30 km. The variability of the Sargasso Sea through wavelengths between 150 km and 5000 km is estimated at + or - 28 cm. This value is in reasonable agreement with oceanographic estimates and is compatible with the eddy kinetic energy of a wind driven circulation. G.G.

N78-27726# Georgia Marine Science Center, Savannah.
THE RESULTS OF FOUR OCEANOGRAPHIC CRUISES IN THE GEORGIA BIGHT
L. P. Atkinson (Skidway Inst. of Oceanography, Savannah, Ga.) 1978 78 p refs
(Grant NOAA-04-7-158-44126)
(PB-279422/0; TR-78-1; NOAA-78021303) Avail: NTIS HC A05/MF A01 CSCL 08J

Background seasonal data with which to plan more specific experiments are reported. The data are presented in graphical form with interpretation. Temperature-salinity relationships and patterns in the Georgia Bight are consistent and reasonably predictable as are the nutrient relationships. The distribution of freshwater in the offshore waters is easily detected but the forces that disperse the waters and produce the distribution are not understood. GRA

N78-27727# National Oceanic and Atmospheric Administration, Seattle, Wash. Pacific Marine Environmental Lab.
DEEP OCEAN MINING ENVIRONMENTAL STUDY (DOMES). UNPUBLISHED MANUSCRIPT NUMBER 21. BACTERIA AND SEDIMENT INTERACTION
Robert J. Ozretich and Rachel A. Ozretich Jan. 1978 25 p refs
(PB-279630/8; NOAA-78022704) Avail: NTIS HC A02/MF A01 CSCL 08A

Experiments on shipboard and in the laboratory were designed to determine whether the elevated particulate load expected from mining activity would increase bacterial respiration in the water column. During the ship board experiments ATP levels and the products of nitrate respiration were correlated and both measurements were highest at sediment loads of 1 to 10 mg/l. At sediment levels of 100 and 1000 mg/l inhibition of respiration was indicated. ETS activities were proportional to the sediment load. The results to date indicate that an increase in bacterial biomass and respiration may be expected from the dispersion of mining fines into the water column. ATP (biomass) and ETS activity (potential respiration) are crucial measurements, and should be incorporated into the experimental design of the industry monitoring study. GRA

N78-27728# Du Pont de Nemours (E. I.) and Co., Aiken, S. C.
NORTH CAROLINA COASTAL ZONE AND ITS ENVIRONMENT: A COMPILATION OF RESOURCE MATERIALS COVERING THE COASTAL PLAIN, ESTUARIES, AND OFFSHORE WATERS
H. W. Dubach, comp. Nov. 1977 192 p 2 Vol.
(Contract EY-76-C-09-0001)
(DP-1423-Vol-1) Avail: NTIS HC A09/MF A01

This North Carolina coastal zone bibliography contains 1155 references to literature on environmental conditions of the coastal zone of the South Atlantic Bight. References are arranged in ten subject categories according to the primary information content of each item. Descriptors which may be used in automating the collection are supplied for each title, the descriptors were used for indexing. Scientific and technical literature dealing with the land area of North Carolina between the Piedmont and the shoreline and with the offshore water to the continental slope are cited. Topics cover general biology, geology and geophysics, engineering projects, and fish and fisheries. ERA

N78-27729# Du Pont de Nemours (E. I.) and Co., Aiken, S. C.
NORTH CAROLINA COASTAL ZONE AND ITS ENVIRONMENT: A COMPILATION
Harold W. Dubach, comp. Nov. 1977 203 p 2 Vol.
(Contract EY-76-C-09-0001)
(DP-1423-Vol-2) Avail: NTIS HC A10/MF A01

This bibliography contains 630 references to literature on environmental conditions of the coastal zone of the South Atlantic Bight and the land area of North Carolina between the Piedmont and the shoreline and with the offshore water to the continental slope. References are included to literature on hydrology and ground water, weather and climate, and oceanography. ERA

N78-27730# Skidaway Inst. of Oceanography, Savannah, Ga.
BIOLOGICAL PROCESSES IN THE WATER COLUMN OF THE SOUTH ATLANTIC BIGHT Progress Report
G. A. Paffenhofer and W. M. Dunstan Feb. 1978 31 p
(Contract EY-76-S-09-0936)
(SRO-936-2) Avail: NTIS HC A03/MF A01

Results from two drogue experiments designed to follow

water masses intruded from the Gulf Stream onto the continental shelf of the Georgia Bight are presented. Biological processes in distinct intruding water masses over an extended period measuring changes in phytoplankton, particle and zooplankton concentration, and composition were studied and interrelationships between different trophic levels are described. A correlation was made between observed changes with hydrographic and other data on water mass movements. The following appendices are included: the chemical and biological effect of a Gulf Stream intrusion of St. Augustine, Florida; Laboratory and field observations of pelagic tunicate distribution, feeding, and growth; and the distribution of planktonic blue green algae related to the hydrography of the Georgia Bight. ERA

N78-27731# Texas A&M Research Foundation, College Station.
DEEP OCEAN MINING ENVIRONMENTAL STUDY (DOMES). UNPUBLISHED MANUSCRIPT NUMBER 10: DISPERSION OF WASTE SEDIMENT FROM A POINT-SOURCE DISCHARGE
T. Ichiye and M. Carnes 1977 128 p
(PB-279972/4; NOAA-77101707) Avail: NTIS HC A07/MF A01 CSCL 08C

Point source models were used for predicting dispersion of waste sediment discharged near the surface of a deep sea mining operation. The proposed discharge method is more like a point source rather than a line source, though the line source can simulate general cases of sediment discharge which may occur during mining operations. Also, point source models can be generalized to incorporate Lagrangian statistical properties of turbulence in the ocean as these properties become known from results of DOMES (Deep Ocean Mining Environmental Study) observational programs. The results can be presented in rather simple mathematical formulas and can be applied easily to different practical conditions. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N78-27732 California Univ., San Francisco.
ELECTROPHYSIOLOGIC AND PHARMACOLOGIC PROPERTIES OF MAMMALIAN SENSORY NEURONS Ph.D. Thesis
Richard Andrew Jaffe 1977 221 p
Avail: Univ. Microfilms Order No. 7809195

Passive and active electrical properties of the soma membrane of neurons in nodose ganglia removed from cats and rabbits were studied. The ganglia were maintained in vitro and were superfused at 37 C with a solution formulated to approximate the extracellular fluid of each species. The pharmacologic actions of a variety of drugs were tested on neurons in cat and rabbit nodose ganglia. Results suggest that the cell bodies possess receptors for drugs, and that drug-induced effects may result in the initiation of action potentials or the modification of pre-existing activity. Thus, the nodose ganglion may be an important site of action for the autonomic effects of some drugs. Dissert. Abstr.

N78-27733* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TREAD DRUM FOR ANIMALS Patent
Wayne H. Howard, inventor (to NASA) Issued 9 May 1978 7 p Filed 31 Mar. 1976 Supersedes N76-20485 (14 - 11, p 1394)
(NASA-Case-ARC-10917-1; US-Patent-4,088,094; US-Patent-Appl-SN-672223; US-Patent-Class-119-29) Avail: US Patent Office CSCL 06B

A device for exercising animals such as primates is described, which includes a cylindrical housing mounted for rotation about a horizontal axis of revolution and has a cylindrical treadway portion on which the animal treads while the drum is rotated by means of a motorized drive. The treadway portion of the drum includes an electrode structure with sectors being independently energizable by means of a commutator and source of potential so that an electrical shock station is created behind a running-in-place station on the moving treadway. In this manner, if the animal should fall behind its running-in-place station, it may be shocked by treading on the energized electrode structure. One end of the tread drum comprises a transparent wall for unobstructed viewing of the animal being exercised.
Official Gazette of the U.S. Patent Office

N78-27734*# National Aeronautics and Space Administration, Washington, D. C.
PLANTS FOR SPACE PLANTATIONS
T. I. Nikishanova Jun. 1978 22 p refs Transl. into ENGLISH from Priroda (USSR), no. 10, 1977 p 105-117 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-2790)
(NASA-TM-75314) Copyright. Avail: NTIS HC A02/MF A01 CSCL 06C

Criteria for selection of candidate crops for closed life support systems are presented and discussed, and desired characteristics of candidate higher plant crops are given. Carbohydrate crops, which are most suitable, grown worldwide are listed and discussed. The sweet potato, ipomoea batatas Poir., is shown to meet the criteria to the greatest degree, and the criteria are recommended as suitable for initial evaluation of candidate higher plant crops for such systems. Author

N78-27735*# National Aeronautics and Space Administration, Washington, D. C.
VESTIBULAR REACTIONS TO LONG-TERM CALORIC STIMULATION OF THE RABBIT LABYRINTH
G. I. Gorgiladze Jul. 1978 7 p refs Transl. into ENGLISH from Zh. Vyssh. Nervn. Deyateln. im. I. P. Pavlova (USSR), v. 28, no. 1, Jan.-Feb. 1978 p 192-194 Transl. by Sci. Transl. Serv., Santa Barbara, Calif.
(Contract NASw-2791)
(NASA-TM-75528) Avail: NTIS HC A02/MF A01 CSCL 06S

Long-term, periodically repeated caloric stimulation of the labyrinth receptors of the internal ear was studied on eight rabbits with immobilzed heads. Warm (20 C) water was used as a stimulus in a dose of 40 ml per min injected into the auditory meatus. Author

N78-27736*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
CV 990 INTERFACE TEST AND PROCEDURE ANALYSIS OF THE MONKEY RESTRAINT, SUPPORT EQUIPMENT, AND TELEMETRY ELECTRONICS PROPOSED FOR SPACELAB
Bernard D. Newsom Jun. 1978 85 p refs
(NASA-TM-78484; A-7417) Avail: NTIS HC A05/MF A01 CSCL 06C

A biological system proposed to restrain a monkey in the Spacelab was tested under operational conditions using typical metabolic and telemetered cardiovascular instrumentation. Instrumentation, interfaced with other electronics, and data gathering during a very active operational mission were analyzed for adequacy of procedure and success of data handling by the onboard computer. G.G.

N78-27737*# State Univ. of New York at Buffalo, Amherst.
ASSESSMENT OF PANCREAS CELLS Final Report
C. VanOss 5 Jun. 1978 11 p refs
(Contract NAS9-15365)
(NASA-CR-151744) Avail: NTIS HC A02/MF A01 CSCL 06C

Pancreatic islets were obtained from guinea pig pancreas by the collagenase method and kept alive in tissue culture prior to further studies. Pancreas cell morphology was studied by standard histochemical techniques using light microscopy. Preparative vertical electrophoresis-levitation of dispersed fetal guinea pig pancreas cells was conducted in phosphate buffer containing a heavy water (D20) gradient which does not cause clumping of cells or alter the osmolarity of the buffers. The faster migrating fractions tended to be enriched in beta-cell content. Alpha and delta cells were found to some degree in most fractions. A histogram showing the cell count distribution is included. P.R.A.

N78-27738*# National Aeronautics and Space Administration, Washington, D. C.
THE MATCHING OF BIOLOGICAL AND TECHNICAL ELEMENTS AND SYSTEMS

Yu. I. Zozulya Jun. 1978 12 p refs Transl. into ENGLISH from Probl. Bioniki (USSR), no. 14, 1975 p 12-19 A76-13911 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(NASA-TM-75313) Avail: NTIS HC A02/MF A01 CSCL 06C

The conditions necessary for matching the input-output relationships of nonlinear dynamic systems without memory and with image memory are discussed. A structural representation is provided for the input-output relationships of matched elements and systems with distributed kernels. G.G.

N78-27739# Purdue Univ., Lafayette, Ind. Joint Highway Research Project.
EVALUATION OF SEVERAL METHODS OF ESTABLISHING PLANT COVER BY SEEDING ON THE ROADSIDE Interim Report
P. L. Carpenter, David Hensley, and Deborah Newbill Nov. 1977 36 p refs
(PB-278275/3; JHRP-76-34) Avail: NTIS HC A03/MF A01 CSCL 13B

Several woody plant species were direct seeded on a roadside slope. Of the species that germinated, seeding survival declined over time. Cercis canadensis and Robinia pseudoacacia appeared to provide some cover, however natural seeding of these native plants also occurred in unseeded plots and buffers. Mixtures of grasses and herbaceous legumes were used for erosion control. Auena sativa provided rapid cover and held the seeds of more desirable species in the bottom of the existing gullies. Coronilla varia established permanent cover and halted erosion by the second season. Wheat straw, shredded hardwood bark, and shredded rubber tires were evaluated as mulch materials for newly seeded slopes. Shredded bark and wheat straw gave excellent results, however, shredded rubber was inferior even to the check. GRA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N78-27740 Duke Univ., Durham, N. C.
DETERMINING THE NUMBER AND POSITIONS OF MEASURING LOCATIONS FOR BODY SURFACE POTENTIAL MAPPING Ph.D. Thesis
Robert Burton Warren 1977 458 p
Avail: Univ. Microfilms Order No. 7807640

Body surface potential distributions (maps) were obtained from a large patient population and represented a wide variation in age, time in the cardiac cycle, and cardiac condition. These maps were split into two groups, an analysis group for deriving lead systems, and a test group for evaluating the results. The geometric relationships were obtained by direct measurement from heart and torso models. The electrical activity of the heart was represented in terms of fundamental patterns set up on the body surface by hypothetical spatially fixed equivalent cardiac generators. The results demonstrate that the fundamental patterns derived from measured maps embody geometric information about the relationship between heart activity and body surface effects. Dissert. Abstr.

N78-27741 Utah Univ., Salt Lake City.
PROCESSING OF ECHOCARDIOGRAPHIC DATA FOR AUTOMATIC DETECTION OF MOVING HEART STRUCTURES Ph.D. Thesis
Dominic Julius Heuscher 1978 168 p
Avail: Univ. Microfilms Order No. 7808325

A border detection system was developed which uses pattern matching and dynamic search techniques designed to recognize and isolate a designated structure from others within the same time-motion segment, then find the best path, based upon a given merit function, describing the motion for that structure. These techniques allow known information regarding the shape, location, relative intensity, etc., to be effectively incorporated into the search for the correct border. This system has demonstrated that borders can be detected quickly and correctly for a scan throughout the left ventricle. The shape and location of these borders compared favorably with hand-traced borders obtained from the same data. In addition, borders were obtained for selected positions of the transducer to demonstrate the ability to detect a variety of structures throughout the heart. Dissert. Abstr.

N78-27742 Nebraska Univ., Lincoln.
DEVELOPMENT OF A SINGLE-UNIT, MULTIOUTPUT SENSING ELEMENT IN A FORCE PLATFORM FOR USE IN BIOMECHANICS APPLICATIONS Ph.D. Thesis
William Edward Handy 1977 289 p
Avail: Univ. Microfilms Order No. 7809155

The platform can be used to determine the three orthogonal components of a force applied to it, the two-dimensional location of the force and the torque about the vertical axis. Force components are directly proportional to strain outputs. Position and torque must be calculated from measured quantities. The sensing element was constructed from a 24-inch square by 1.5-inch thick aluminum plate. Slots in the plate form four sensing beams and a torque-sensing cross. A top walk plate is attached at the center of the element. The element is supported at the four outside corners. A load applied to the top plate is transferred through the torque sensing cross to each of the two pairs of opposed load-sensing beams in sequence. Sixty-four strain gages are mounted on the four load-sensing beams and the torque-sensing cross to form the six multi-gage-arm bridges. Dissert. Abstr.

N78-27743 Case Western Reserve Univ., Cleveland, Ohio.
IMPLANTABLE TELEMETRY SYSTEM FOR INTRACRANIAL PRESSURE MONITORING AND ITS APPLICATION FOR ACETAZOLAMIDE STUDY Ph.D. Thesis
Edward Man-Yau Cheng 1978 129 p
Avail: Univ. Microfilms Order No. 7809273

A single channel and two-channel intracranial pressure - temperature telemetry systems were designed and constructed. These systems are capable of being powered by external radio frequency (RF - 3.5 MHz) and the ICP signal is transmitted at another frequency (RF - 120 MHz). A total of seventeen implants were evaluated in dog experiments with satisfactory results. Application of the telemetry system has also been extended to the evaluation of acetazolamide effect on intracranial pressure of awake animals. Five prototype two channel units are being constructed for clinical evaluation. Dissert. Abstr.

N78-27744 Texas Univ. at Austin.
THE DESIGN AND EVALUATION OF MULTIMEMBRANE ULTRAFILTRATION HEMO-SEPARATING SYSTEMS Ph.D. Thesis
Glen Delbert Antwiler 1977 197 p
Avail: Univ. Microfilms Order No. 78-07255

The concept of using a multimembrane ultrafiltration system to separate plasma from whole blood followed by a secondary separation of a smaller fraction of solutes was studied. This work included mathematical models of ultrafiltration systems and in vitro and in vivo experiments with emphasis on separating plasma from blood. It was shown that with the proper choice of membrane and flow geometry, plasma can be separated from whole blood with minimum hemolysis and destruction of white cells and platelets. Also, none of the dogs used showed any abnormal effects after the experiments. Dissert. Abstr.

N78-27745 New York Univ., N. Y.
LEARNED VOLUNTARY CONTROL OF SYSTOLIC BLOOD PRESSURE BY SPINAL CORD INJURY PATIENTS Ph.D. Thesis
Bernard S. Brucker 1977 134 p
Avail: Univ. Microfilms Order No. 7808452

The training consisted of 25 one hour sessions. Each session consisted of four, 4-minute training periods, each preceded and followed by a 4-minute rest period. On three of the training periods, the participant was asked to increase his blood pressure and, as a control for the effort of paying attention to a task, on the fourth trial, which randomly appeared in different parts of the sequence on different days, was asked to try to keep his blood pressure from increasing. The participant was instructed not to tense muscle or change respiratory rate throughout the training sessions. Blood pressure, heart rate, respiratory rate and EMG were continuously measured and recorded on an eight

channel polygraph. Analysis of the results revealed that nine of the ten participants learned to make reliable and large voluntary increases in blood pressure with and without the feedback present that were specific to command and not mediated through voluntary muscle mechanisms. Dissert. Abstr.

N78-27746 State Univ. of New York at Buffalo, Amherst.
THE INTERACTION OF THROMBIN AND PLATELETS Ph.D. Thesis
Bernice Michaelene Martin 1976 146 p
Avail: Univ. Microfilms Order No. 7806882

To investigate the role of thrombin in the in vitro stimulation of platelets, both the kinetics of the secretion of Ca2+ and ATP and the direct binding of 125I-thrombin were studied. The results indicated that while catalytically active thrombin is required for platelet stimulation, catalytic activity is not required for binding. Studies of binding in correlation with secretion showed that saturation of the secretion reaction occurred at thrombin levels well below that required for saturation of binding, indicating that not all binding sites are required for stimulation of the secretion reaction. At thrombin levels below saturation of the secretion reaction, most (75-85%) of the thrombin was not bound to platelets. Furthermore, the unbound thrombin was found to behave identically to native thrombin in molecular sieve chromatography and on SDS gels, and was fully reactive when challenged by additional platelets. Dissert. Abstr.

N78-27747*+ National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 181
Jun. 1978 70 p refs
(NASA-SP-7011(181)) Avail: NTIS HC E02 CSCL 06E

This bibliography lists 223 reports, articles, and other documents introduced into the NASA scientific and technical information system in May 1978. Author

N78-27748 Stanford Univ., Calif.
A MINIATURE INTEGRATED CIRCUIT ACCELEROMETER FOR BIOMEDICAL APPLICATIONS Ph.D. Thesis
Lynn Michelle Roylance 1978 207 p
Avail: Univ. Microfilms Order No. 7808836

Integrated circuit fabrication technology has permitted the development of an accelerometer weighing less than 0.02 gm, in a 2x3x0.6 mm package. The accelerometer is intended for biomedical applications such as measurement of heart wall motion and intrauterine motion, where extremely small mass is necessary to avoid measurement artifact. In addition, such applications require a transducer which will detect accelerations down to 0.01 g over a 100 Hertz bandwidth, with an upper acceleration limit of 50 g. Experimental results agree closely with the theoretically derived dependence of output on acceleration. The observed resistance change is proportional to the applied acceleration, and depends on the length, thickness, and width of the beam, and on the magnitude and placement of the mass. The dependence on beam geometry allows the sensitivity to be readily varied over several orders of magnitude yet remain tightly controlled. Dissert. Abstr.

N78-27749 Stanford Univ., Calif.
A SILICON ABSOLUTE PRESSURE TRANSDUCER FOR BIOMEDICAL APPLICATIONS Ph.D. Thesis
Timothy Alan Nunn 1978 106 p
Avail: Univ. Microfilms Order No. 78-08820

The miniature transducer (1.0 mm x 1.25 mm x 0.4 mm) can be totally batch fabricated using integrated circuit processing techniques, thus yielding a low cost device. The pressure transducer consists of a silicon chip, containing a silicon diaphragm with p-type resistors diffused into it, which is hermetically sealed to a glass cap. An anodic bonding process is used for this sealing and results in a very stable bond. The use of inherently stable materials resulted in a pressure transducer that was very stable with time. The long term drift has been measured as being less than 1 torr per month. Analysis of the stress patterns on the silicon diaphragm combined with analysis of the piezoresistive effect resulted in positioning and orienting the p-type resistors so as to maximize the transducer pressure sensitivity. Dissert. Abstr.

N78-27750*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
URINE COLLECTION DEVICE Patent Application
Roger B. Michaud, inventor (to NASA) (Martin Marietta Corp., Denver, Colo.) Filed 30 May 1978 27 p
(Contract NAS9-14796)
(NASA-Case-MSC-16433-1; US-Patent-Appl-SN-910992) Avail: NTIS HC A03/MF A01 CSCL 06B

The invention relates to a urine collection device particularly adapted to the female anatomy. The device is designed for use primarily by incontinent women, but also has application in those circumstances which preclude access to normal bathroom facilities, for example where the woman is bed-ridden, or is in an occupation which demands long periods at a duty station or in protective clothing (pilots or astronauts). The device successfully overcomes many of the problems associated with present devices, such as absorbent garments (akin to diapers or sanitary napkins), external receptacles strapped to the body, and catheters, which problems usually include leakage, urine contact with the body, discomfort, infection, interference with freedom of movement, and limitations on choice of clothing. NASA

N78-27751*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HYPERTHERMIA AS AN ANTINEOPLASTIC TREATMENT MODALITY
Sheila Ann T. Long, ed., James Shaeffer, ed. (Eastern Va. Med. School), and Anas M. El-Mahdi, ed. 1978 98 p refs Symp. held at Norfolk, Va., 28 Jan. 1978
(NASA-CP-2051; L-12082) Avail: NTIS HC A05/MF A01 CSCL 06E

Improved methods of treating tumorous cancers with hyperthermia are discussed. Conceptual and technical problems that relate to the fabrication and utilization of therapeutic radio frequency heating equipment and thermal measuring equipment are outlined. G.G.

N78-27752*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF PROLONGED HYPOKINESIA ON THE WATER AND FAT CONTENT OF THE HUMAN BODY
V. P. Krotov, Ye. A. Kovalenko, and Z. P. Katuntsev Jul. 1978 7 p refs Transl. into ENGLISH from Byull. Eksp. Biol. Med. (USSR), vol. 8, no. 3, Mar. 1976 p 279-281 Transl. by SCITRAN, Santa Barbara, Calif.
(Contract NASw-2791)
(NASA-TM-75522) Avail: NTIS HC A02/MF A01 CSCL 06S

The combined action is studied of prolonged hypokinesia (30-49 days) and different position in relation to the vector of gravitation on body composition of healthy men. In an antiorthostatic position of the subject the run-off of water occurs mainly in the first several days. As a result of prolonged hypokinesia the lean body weight is reduced, and the water content in it is decreased. The latter is rapidly restored during resumption of motor activity. G.G.

N78-27753*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF 6-DAY HYPOKINESIA ON OXYGEN METABOLISM INDICES IN ELDERLY AND SENILE SUBJECTS
L. A. Ivanov and P. A. Orlov Jul. 1978 6 p refs Transl. into ENGLISH from Byull. Eksp. Biol. Med. (USSR), v. 76, no. 7, Jul. 1973 p 35-37 Transl. by Scientific Transl. Service, Santa Barbara, Calif.
(Contract NASw-2791)
(NASA-TM-75521) Avail: NTIS HC A02/MF A01 CSCL 06S

After a strict 6 day confinement to bed of elderly and senile subjects the oxygen supply of the subcutaneous cellular tissue was impaired, and the intensity of its tissue respiration was somewhat reduced. The vacat-oxygen of the blood and urine, the coefficient of incomplete oxidation, and the oxygen deficiency in the organism were increased. Author

N78-27754*# National Aeronautics and Space Administration, Washington, D. C.
CHANGES IN THE HUMAN BLOOD COAGULATING SYSTEM DURING PROLONGED HYPOKINESIA
L. M. Filatova and O. D. Anashkin Jun. 1978 9 p refs

Transl. into ENGLISH from Byull. Eksp. Biol. Med. (USSR), v. 65, no. 6, 1968 p 36-39 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Inst. of Med. and Biol. Probl. of the Min. of Public Health USSR, Moscow
(Contract NASw-2790)
(NASA-TM-75520) Avail: NTIS HC A02/MF A01 CSCL 06S

Changes in the coagulating system of the blood were studied in six subjects during prolonged hypokinesia. Thrombogenic properties of the blood rose in all cases on the 8th day. These changes are explained by stress reaction due to unusual conditions for a healthy person. Changes in the blood coagulating system in the group subjected to physical exercise and without it ran a practically parallel course. Apparently physical exercise is insufficient to prevent such changes that appear in the coagulating system of the blood during prolonged hypokinesia. Author

N78-27755# Civil Aeromedical Inst., Oklahoma City, Okla.
SPATIAL DISORIENTATION IN GENERAL AVIATION ACCIDENTS
William R. Kirkham, William E. Collins, Paula M. Grape, James M. Simpson, and Terry F. Wallace Mar. 1978 15 p refs
(AD-A053230; FAA-AM-78-13) Avail: NTIS HC A02/MF A01 CSCL 05/10

Spatial disorientation (SD) refers to an incorrect self-appraisal of the attitude or motion of the pilot and his aircraft with respect to the earth. This paper defines elements of SD problems as encountered in general civil aviation. Accident reports made by the National Transportation Safety Board for a recent 6 year period were reviewed. Statistical computations were made relating SD to fatal accidents. SD was involved in 2.5 percent of all general aviation accidents, nonfatal and fatal. However, SD ranked as the third highest 'cause' in fatal small fixed-wing aircraft accidents and is closely related to the second highest cause, continued VFR flight into adverse weather. Inclement weather was associated with 42 percent of all fatal accidents, and SD was a cause or factor in 35.6 percent of these cases. Fog (56.8 percent) and rain (41.8 percent) were the most prevalent adverse weather conditions. Non-instrument-related pilots were involved in 84.7 percent of SD weather-involved accidents. These and other data attest to the importance of this psychophysiological phenomenon (SD) in flight safety. Suggestions are made of ways to improve pilots' awareness and understanding of this problem. Author

N78-27756# Civil Aeromedical Inst., Oklahoma City, Okla.
RADIOBIOLOGICAL ASPECTS OF HIGH ALTITUDE FLIGHT: RELATIVE BIOLOGICAL EFFECTIVENESS OF FAST NEUTRONS IN SUPPRESSING IMMUNE CAPACITY TO AN INFECTIVE AGENT
Wallace Friedberg, Barbara R. Neas, Donald N. Faulkner, Gerald D. Hanneman, and E. B. Darden, Jr. (ORNL) Feb. 1978 7 p refs
(AD-A053204; FAA-AM-78-8) Avail: NTIS HC A02/MF A01 CSCL 06R

The relative biological effectiveness (RBE) of fast neutrons is compared with that of X-rays in impeding development of immunity to an infective agent, the intestinal cestode Hymenolepis nana. Mice were irradiated with neutrons or X-rays and 2 days later given an immunizing dose of H. nana eggs. After another 2 days, the mice received a challenge dose of the eggs. Challenge egg doses were also given to sham-irradiated unimmunized and immunized controls. All mice were killed 90 to 92 hours after challenge, and the H. nana larvae (cysticercoids) that developed in the intestinal tissue were counted. An increased cysticercoid count in the irradiated mice, as compared with the count in unirradiated immunized controls, reflects suppression of immune capacity by the radiation. The results indicate a neutron RBE of 4 at 50 and 101 rad. G.G.

N78-27757# Bureau of Mines, Pittsburgh, Pa.
SIMULATION OF MAN'S RESPIRATORY AND METABOLIC FUNCTIONS BY THE AUTOMATED BREATHING METABOLIC SIMULATOR
Maria I. DeRosa and Roy Levin 1978 23 p
(PB-278544/2; BM-IC-8766) Avail: NTIS HC A02/MF A01 CSCL 06P

The Automated Breathing Metabolic Simulator and its hardware and software systems are described. Emphasis is given to the role exerted by the software program subroutines in controlling the hardware mechanisms during the simulation of man's respiratory and metabolic functions. GRA

N78-27758# Technology, Inc., San Antonio, Tex. Life Sciences Div.
OCULAR HAZARDS OF PICOSECOND AND REPETITIVE-PULSED LASERS. VOLUME 1: Nd YAG LASER (1064 NM) Final Report, 16 Feb. 1973 - 15 Feb. 1976
H. W. Hemstreet, Jr., J. S. Connolly, and D. E. Egbert Apr. 1978 47 p refs
(Contract F41609-73-C-0016)
(AD-A053765; TI-77-0564-03-Vol-1; SAM-TR-78-20) Avail: NTIS HC A03/MF A01 CSCL 06/18

Retinal damage thresholds are discussed for exposure of rhesus maculae to continuous wave and repetitive-pulse trains of 1064 nm Nd:YAG laser radiation. For all single-pulse exposures and for repetitive pulses contained within a 0.05 sec train, retinal damage appears to be induced primarily by thermal mechanisms. For the longer pulse-train durations, a cumulative effect is apparent when the repetition frequencies are in the range of 1 to 100 Hz. Experiments were conducted in such a way that direct comparisons could be made with previous data and that accumulated results could be compiled into a self-consistent empirical model.
Author (GRA)

N78-27759# Technology, Inc., San Antonio, Tex. Life Sciences Div.
OCULAR HAZARDS OF PICOSECOND AND REPETITIVE-PULSED LASERS. VOLUME 2: ARGON-ION LASER (514.5 NM) Final Report, 16 Feb. 1973 - 15 Feb. 1976
J. S. Connolly, H. W. Hemstreet, Jr., and D. E. Egbert Apr. 1978 84 p refs
(Contract F41609-73-C-0016)
(AD-A053766; TI-77-0564-03-Vol-2; SAM-TR-78-21) Avail: NTIS HC A05/MF A01 CSCL 06/18

Retinal damage thresholds were determined for exposures of the maculae of rhesus monkeys to CW and repetitive-pulse trains of argon-ion laser radiation at 514.5 nm in the TEM00 mode. Single-pulse exposures were made at pulsewidths of 2, 10, 40, and 100 microsec and 1, 10, 100, and 500 msec. Repetitive-pulse exposures were made for 27 different combinations train durations of 05, 0.5, 5, and 30 sec pulse repetition frequencies from 0.10 Hz to 10 KHz and pulsewidths of 10, 40, and 100 microsec and 1 msec. Damage thresholds for mode-locked argon laser pulses at 104 MHz and 250 psec pulsewidth for pulse trains of 9.9 sec, 10 msec, and 10 microsec duration were also measured. For pulsewidths of 10 microsec, there is an apparent cumulative effect provided the repetition frequencies are in the range of approximately 0.1 to approximately 10 Hz. The retina is more sensitive to double-pulse exposures, by a factor of 2 to 3 relative to single-pulse thresholds, when the interpulse spacing is approximately 2.5 sec. Nonthermal damage mechanisms, involving a two-step, two-threshold process, may explain our results. Specifically, for double-pulse configurations, the first acts as a reversible photo-trigger which sensitizes the retina in preparation for the subsequent pulse. The elements of an empirical model have been assembled and appear to account satisfactorily for the observed double-pulse threshold data.
Author (GRA)

N78-27760# Pennsylvania State Univ., University Park. Applied Research Lab.
DETECTION OF AN OCTAVE BAND OF NOISE AS A FUNCTION OF STIMULUS PRESENTATION M.S. Thesis
Paul T. Cornell 4 Nov. 1977 128 p refs
(Contract N00017-73-C-1418)
(AD-A053756; ARL/PSU/TM-77-311) Avail: NTIS HC A07/MF A01 CSCL 06/16

Two experimental methods were developed to examine the effects of time uncertainty and other variables on the detection of a 500 Hz centered octave band of noise presented in noise. In one method, denoted the fixed presentation method, the signal was presented at a fixed SNR, following a specified interval of time after the onset of an ambient noise stimulus. The other method, the modified threshold-forced response method, presented the signal with the noise at the start of the trial at a low SNR. During the trial, the SNR increased at a constant rate of one-half

DB per two seconds. Upon attaining a specified SNR, the stimulus was gated. Six levels of ending SNR were examined with each method. Four subjects responded on a six-point confidence rating sale. Results indicated that with the variable SNR method, performance was much worse than in the fixed SNR method. Not only were confidences lower, but the probability correct was likewise lower. Results also indicated that subjects could maintain a fairly consistent set of criteria throughout the experiment, as rank ordered correlations of responses to identical tapes were generally high. Consistency was found to increase with SNR. GRA

N78-27761# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.

RECURRENT HEAT EXPOSURE: EFFECTS ON HORMONAL RESPONSES IN RESTING AND EXERCISING MEN

R. P. Francesconi, J. T. Maher, J. W. Mason (Walter Reed Army Inst. of Research, Washington, D. C.), and G. D. Bynum 14 Feb. 1977 25 p refs

(AD-A050539; USARIEM-M-9/77) Avail: NTIS HC A02/MF A01 CSCL 06/19

Heat acclimatization was induced in a group of healthy young men by walking on a treadmill (5.6 km/hr, 49 C/27 C dry/wet bulb, 90 min/ day, 7 days), and confirmed by recording significantly reduced final rectal temperatures and heart rates on the 7th day of exercise in the heat. A 2d group, paired for maximal O2 consumption and body weight, remained sedentary under identical conditions. After correcting for minor changes in hematocrit, both groups demonstrated significant reductions in plasma cortisol on the control day, indicating a strong anticipatory response. Heat exposure reduced plasma cortisol levels in the sedentary men, but the mild exercise program neutralized these effects in the exercising group. Patterns of alteration of growth hormone indicated a significant response even to the mild exercise program described here, while heat stress, pre- and post-acclimatization, seemed to have no effect upon plasma levels. Plasma total T4 levels demunstrated several randomized changes which, however, did not reflect decreased output under the environmental conditions described here for either the walking or sedentary group. The mild exercise program elicited significantly reduced levels of plasma insulin which were not affected by the recurrent heat exposure. While recurrent heat exposure effected hormonal responses among both exercising and sedentary groups, these alterations were not correlated with the process of heat acclimatization. GRA

N78-27762# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.

MECHANISM OF THE ATTENUATED CARDIAC RESPONSE TO BETA-ADRENERGIC STIMULATION IN CHRONIC HYPOXIA

John T. Maher, Joseph C. Denniston, Danney L. Wolfe, and Allen Cymerman 14 Oct. 1977 22 p refs

(AD-A050147; USARIEM-M-2/78) Avail: NTIS HC A02/MF A01 CSCL 06/19

A bluntiung of the chronotropic and inotropic responses of the heart to beta-adrenergic stimulatin occurs following chronic exposure to hypobaric hypoxia. To pursue the mechanism(s) involved, observations were made in 6 intact, conscious goats at sea level and in another 6 goats maintained in a decompression chamber at 445 torr (approximately 4,300 m) for 10 days. No significant group differences in cardiac frequency and various indices of myocardial performance were demonstrable either before or after cholinergic blockade with intravenous atropine methyl bromide, 1 mg/kg. Following hemodynamic studies, thoracotomies were performed and full-thickness biopsies were obtained from the free wall of each of the cardiac chambers. Neither monoamine oxidase activity nor norepinephrine level of any region of the heart was altered by chronic hypoxia. However, a twofold increase (P -.001) in catechol O-methyltransferase activity above sea-level values was found in both the atria and ventricles of the hypoxic animals. Thus, attenuation in cardiac responsiveness to beta-adrenoceptor stimulation in chronic hypoxia appears unrelated to the level of vagal activity, but may be attributable to enhanced enzymatic inactivation of catecholamines. GRA

N78-27763# Army Research Inst. of Environmental Medicine, Natick, Mass.

INTERACTION OF CARDIORESPIRATORY PHYSICAL FITNESS AND HEAT TOLERANCE

Kent B. Pandolf Jan. 1978 15 p refs

(AD-A050149; USARIEM-M-11/78) Avail: NTIS HC A02/MF A01 CSCL 06/16

Most authors agree that physical training in a cool environment improves tolerance to work in the heat and heat acclimatization but the extent or degree of improvement remains controversial. The major benefits of physical training appear to involve exposure durations (heat) of less than two hours. The best improvement in heat tolerance is associated with intensive interval or continuous training at a training intensity greater than 50% of the maximal oxygen uptake for 8 to 12 weeks the maximal oxygen uptake should be increased 15-20%. Generally, individuals with high maximal oxygen uptake values, previously trained and endurance athletes, are at an advantage in the heat. utilization of proper physical training appears to produce about 50% of the total adjustment resulting from heat acclimatizaton, while increased fitness is associated with greater retention of acclimatization in cool environments. Author (GRA)

N78-27764# Indiana Univ., Bloomington. Inst. for Research in Public Safety.

DRIVER VISUAL LIMITATIONS DIAGNOSIS AND TREATMENT Final Report, 1 Jul. 1975 - 30 Oct. 1977

David Shinar 6 May 1977 307 p refs

(Contract DOT-HS-5-01275)

(PB-278884/2; DOT/HS-803-260) Avail: NTIS HC A14/MF A01 CSCL 06P

The role of vision in driving is reviewed. Reliability and validity of the Mark 2, a prototype battery of eight driving-related vision tests, and the relationship between poor performance on the Mark 2 and clinically diagnosed visual impairments were evaluated. A total of 890 subjects were tested on the Mark 2. The most reliable tests are the tests for static acuity (under conditions of glare, normal illumination, and reducted illumination), dynamic visual acuity, and detection-acquisition-interpretation (a measure of visual search efficiency). Tests considered less reliable and in need of modifications were those designed to measure threshold for angular movement and movement in-depth and angular extent of the visual field in the horizontal axis. GRA

N78-27765# National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, Bethesda, Md.

TRANSCRIPT OF THE MEETING PROCEEDINGS OF NATIONAL COMMISSION FOR THE PROTECTION OF HUMAN SUBJECTS OF BIOMEDICAL AND BEHAVIORAL RESEARCH

1978 286 p Meeting held at Bethesda, Md. 10 Feb. 1978; sponsored in part by HEW

(PB-279639/9; NCPHS/M-78/02) Avail: NTIS HC A13/MF A01 CSCL 06E

The following topics are discussed: institutional review boards; ethical principles and guidelines for research; and proposed sterilization regulations. GRA

N78-27766# National Jewish Hospital and Research Center, Denver, Colo.

POSSIBLE DESIGNS OF MEDICATION MONITORS Final Report

Thomas S. Moulding Apr. 1978 88 p refs Sponsored in part by American Lung Association, New York

(PB-278973/3; Moulding-78/01) Avail: NTIS HC A05/MF A01 CSCL 06B

A medication monitor is a device which utilizes radioactive material and photographic film to determine when patients remove medication from a dispenser. Mechanical ideas for making this type of dispenser so it can be used for a wide range of medication regimens are presented. The description includes using the idea of a digital clock and memory chips for the time recording system. Also included are details on some of the following: (1) choice of radioactive source and method of sealing source; (2) methods of locking or sealing medication monitors; (3) detailed instructions for using existing devices, (4) a simplified film development system, and (5) a mechanical and electronic means for creating a dispenser to reduce the chance of suicidal overdosage. GRA

N78-27767# National Technical Information Service, Springfield, Va.
UNDERWATER MEDICINE AND PHYSIOLOGY, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Report, 1975 - Mar. 1978
Pernell W. Crockett May 1978 151 p Supersedes NTIS/PS-77/0338; NTIS/PS-76/0264; NTIS/PS-75/278
(NTIS/PS-78/0414/9; NTIS/PS-77/0338; NTIS/PS-76/0264; NTIS/PS-75/278) Avail: NTIS HC $28.00/MF $28.00 CSCL 06S

The physiological effects of decompression, hyperbaric atmospheres, gas mixtures, inert gases, saturation diving, and low temperature in underwater environments are covered in the bibliography. Other related topics included are decompression schedules and safety measures. Reports on underwater clothing and equipment are excluded. GRA

N78-28040# Joint Publications Research Service, Arlington, Va.
COSMONAUTS UNDERGO MEDICAL GROUND TRAINING
N. N. Gurovskiy and A. D. Yegorov *In its* Transl. on USSR Sci. and Technol. (JPRS-71393) 30 Jun. 1978 p 42-49 Transl. into ENGLISH from Zemlya Vselennaya (Moscow), no. 2, 1978 p 11-15 (For primary document see N78-28033 18-99)
Copyright. Avail: NTIS HC A05/MF A01

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N78-27768 Texas Univ., Austin.
INVESTIGATION OF AN ALTERNATIVE RESPONSE TASK FOR SYNTHETIC SENTENCE INDEX Ph.D. Thesis
Martha Joe Hall Wofford 1977 104 p
Avail: Univ. Microfilms Order No. 7807410

Three studies were designed in the development of an alternative response task for the Synthetic Sentence index (SS1). In Study 1, five trained normal hearing judges ranked the vocal stress patterns in the tape recorded SSI with an inter-judge reliability of 0.947. In Study 2, ten normal hearing persons listened to the SSI under seven increasing message-to-competition ratios, from -30 to 0 db, identifying those words they could hear in each sentence. Spearman's Rank-Order Correlation indicated that word position, rather than vocal stress, was more influential in providing cue words for listeners. The four most commonly identified words in each sentence formed the basis for construction of additional printed sentence alternatives in Study 3. The SSI requires modification either in the form of development of percent correction factor values or redesign with attention to the consistency of its competing message. Dissert. Abstr.

N78-27769# Civil Aeromedical Inst., Oklahoma City, Okla.
A COMPARISON OF THE VIGILANCE PERFORMANCE OF MEN AND WOMEN USING A SIMULATED RADAR TASK
Richard I. Thackray, R. Mark Touchstone, and J. Powell Bailey Mar. 1978 11 p refs
(AD-A053674; FAA-AM-78-11) Avail: NTIS HC A02/MF A01 CSCL 05/10

Possible sex differences are considered in the ability to sustain attention to a complex monitoring task requiring only a detection response to critical stimulus changes. The visual display was designed to approximate a futuristic, highly automated air traffic control radar display containing computer-generated alphanumeric symbols. Twenty-six men and an equal number of women were each tested over a 2 hour session. Sixteen targets appeared on the screen at all times, with 10 signals (a designated change in the alphanumerics) randomly presented during each half hour of the test session. Detection latency to the signals increased significantly during the session, but there was no evidence of any significant difference between the sexes in the magnitude or pattern of this increase. The results are discussed in terms of a general decline in alertness that was apparently equal for both sexes. G.G.

N78-27770# California Univ., Los Angeles. Brain Research Inst.
DEVELOPMENT OF NEUROPHYSIOLOGICAL AND BEHAVIORAL METRICS OF HUMAN PERFORMANCE Annual Scientific Report, 1 Oct. 1976 - 30 Sep. 1977
Samuel L. Moise, Jr. 30 Nov. 1977 62 p refs
(Grant AF-AFOSR-3184-77)
(AD-A053018; AFOSR-78-0618TR) Avail: NTIS HC A04/MF A01 CSCL 05/10

The purpose of this program is to develop metrics derived from multidimensional behavioral and neurophysiological indices which may ultimately be applied across a wide range of tasks to describe and predict human performance. This year's effort represented two different approaches to this problem: the development of a methodology for examining clutter factors that affect target identification, and the evaluation of Catastrophe Theory as a potential metric for describing discontinuities in human behavior. Initial analysis of the behavioral data has been computed and is reported here. It is clear that the system provides a powerful, flexible tool for study of visual clutter. A large representative bibliography of application of Catastrophe Theory has been compiled and is part of this report. Evaluation of the usefulness of Catastrophe Theory as a metric for predicting human performance is clear at this time. The theory allows qualitative construction of models which reflect the behavior of systems in which discontinuities are observed, but at present does not allow quantative, predictive modeling of such systems. At present, then, Catastrophe Theory would not seem to be suitable for generating predictive metrics of human performance. GRA

N78-27771# Sandia Labs., Albuquerque, N. Mex.
HUMAN RELIABILITY ANALYSIS OF DEPENDENT EVENTS
A. D. Swain and H. E. Guttmann 23 Aug. 1977 12 p refs Presented at Probabilitic Analysis of Nuclear Reactor Safety, Los Angeles, 8 May 1978
(Contract EY-76-C-04-0789)
(SAND-77-1396C; Conf-780507-3) Avail: NTIS HC A02/MF A01

In the human reliability analysis in WASH-1400, the continuous variable of degree of interaction among human events was approximated by selecting four points on this continuum to represent the entire continuum. The four points selected were identified as zero coupling (i.e., zero dependence), complete coupling (i.e., complete dependence), and two intermediate points-loose coupling (a moderate level of dependence) and tight coupling (a high level of dependence). The paper expands the WASH-1400 treatment of common mode failure due to the interaction of human activities. Mathematical expressions for the above four levels of dependence are derived for parallel and series systems. The psychological meaning of each level of dependence is illustrated by examples, with probability tree diagrams to illustrate the use of conditional probabilities resulting from the interaction of human actions in nuclear power plant tasks. ERA

N78-27772# National Technical Information Service, Springfield, Va.
HUMAN MEMORY. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Apr. 1978
Mary E. Young Apr. 1978 270 p Supersedes NTIS/PS-77/0352, NTIS/PS-76/0352, and NTIS/PS-75/297
(NTIS/PS-78/0348/9; NTIS/PS-77/0352; NTIS/PS-76/0352; NTIS/PS-75/297) Avail: NTIS HC $28.00/MF $28.00 CSCL 05J

This updated bibliography contains 265 abstracts on the abilities and functions of human memory and recall. Memory and learning methods, such as semantics, mnemonics, and visual and acoustic aids are included. GRA

N78-28042# Joint Publications Research Service, Arlington, Va.
SPACECRAFT CREW GROUND TRAINING DESCRIBED
A. G. Nikolyev *In its* Transl. on USSR Sci. and Technol. (JPRS-71393) 30 Jun. 1978 p 56-65 Transl. into ENGLISH from Zemlya Vselennaya (Moscow), no. 2, 1978 p 5-10 (For

primary document see N78-28033 18-99)
Copyright. Avail: NTIS HC A05/MF A01

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N78-27773# Civil Aeromedical Inst., Oklahoma City, Okla.
HUMAN RESPIRATORY CONSIDERATIONS FOR CIVIL TRANSPORT AIRCRAFT OXYGEN SYSTEM
E. B. McFadden Mar. 1978 21 p refs
(AD-A053223; FAA-AM-78-9) Avail: NTIS HC A02/MF A01 CSCL 01/3

Information is given to acquaint personnel involved in the design, inspection, and maintenance of civil transport oxygen systems with the human respiratory requirements and oxygen system design considerations necessary to effect an interface and provide acceptable high-altitude life support. Simplified explanations and language and references are given to sources of more detailed information. The oxygen system designer is directed to applicable Federal Aviation Regulations pertaining to oxygen systems and, where regulatory guidance does not exist, directs the reader to applicable oxygen equipment industry practices, standards, and information reports. D.L.G.

N78-27774# Civil Aeromedical Inst., Oklahoma City, Okla.
CHILD RESTRAINT SYSTEMS FOR CIVIL AIRCRAFT
Richard F. Chandler and Edwin M. Trout Mar. 1978 42 p refs
(AD-A053565; FAA-AM-78-12) Avail: NTIS HC A03/MF A01 CSCL 01/3

Child restraint systems were developed to provide protection to children involved in automobile crashes. Six typical systems were exposed to controlled impacts on a test sled to simulate aircraft crash conditions; these systems were inverted to simulate turbulence. A special test seat was developed to represent an aircraft passenger seat for these tests. The results of the tests and characteristics of the child restraint systems that are critical for civil aircraft applications are discussed. G.G.

N78-27775# Qei, Inc., Bedford, Mass.
RESEARCH IN SUPPORT OF JOINT ARMY-NAVY AIR CREW IMPACT INJURY PREVENTION PROGRAM Final Report, 1 Nov. 1969 - 1 Nov. 1977
Rodney W. Thorpe and Harvey E. Sbisa 31 Dec. 1977 55 p refs
(Contract N00014-70-C-0082)
(AD-A053437; QEI-7C31) Avail: NTIS HC A04/MF A01 CSCL 13/12

The research described in this paper falls into two separate categories. First, research was performed to develop and apply mathematical models which would accurately simulate the dynamic response of the living human over a wide range of impact-accelerative forces applied to the human along various vectors. This research would hopefully lead to the specification of a manikin to simulate human response to impact acceleration. Reserach was also performed to determine the physiological response of the human to impact acceleration or the effect of impact-accelerative forces on cardiac and pulmonary functions, skeletal integrity and organ tissue integrity. Second, research was performed and a computer model called MEDCON was developed to determine the requirements in medical personnel and facilities of Navy bumed, at different times and locations before and during a precisely-specified contingency.
Author (GRA)

N78-27776# General Accounting Office, Washington, D. C. Procurement and Systems Acquisition Div.
FEDERAL HUMAN NUTRITION RESEARCH NEEDS A COORDINATED APPROACH TO ADVANCE NUTRITION KNOWLEDGE, VOLUME 1 Report to the Congress
28 Mar. 1978 137 p refs 2 Vol.
(PB 278850/3; PSAD-77-156-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 06H

Several Federal departments and agencies support human nutrition research. However, comprehensive, consolidated information on Federal human nutrition research activities is limited, and some barriers to human nutrition research persist. GAO recommends steps for the executive branch to help overcome these barriers. Information needs to be developed concerning: human nutrition requirements; food composition and nutrient biological availability; diet, disease causation, and food safety; and food consumption and nutritional status. GRA

N78-27777# General Accounting Office, Washington, D. C. Procurement and Systems Acquisition Div.
FEDERAL HUMAN NUTRITION RESEARCH NEEDS A COORDINATED APPROACH TO ADVANCE NUTRITION KNOWLEDGE, VOLUME 2 Report to the Congress
28 Mar. 1978 148 p 2 Vol.
(PB-278851/1; PSAD-77-156-A-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 06H

This second volume of a two volume report contains the observations and views of 32 individuals active in research, training, or clinical practice of human nutrition. The topics addressed were human nutrition gaps and needs. GRA

N78-27778# California Univ., Los Angeles. School of Engineering and Applied Science.
DEVELOPMENT OF A VISIBILITY RESEARCH CAPABILITY Final Report, 30 Jul. 1976 - 5 Aug. 1977
Albert Burg, Jinx Beer, and Mayer E. Brenner Aug. 1977 192 p refs
(Contract DOT-HS-6-01451)
(PB-278152/4; UCLA-ENG-7754; DOT-HS-803-261) Avail: NTIS HC A09/MF A01 CSCL 05E

Driver visibility research is considered that provided realistic stimulus situations to the driver and accurately measured relevant aspects of his performance in response to these situations. Through a review of the literature, discussions with resource people and visits to facilities at which relevant equipment and/or activities could be seen, a number of alternative approaches were comparatively evaluated. The study recommendations were that simulation employing motion picture displays be considered as a short-term means for conducting the desired research, and that on a long term basis consideration be given to the use of simulation with computer-generated imagery, possibly in combination with other visual display techniques. GRA

N78-27779# Ohio State Univ., Columbus. Dept. of Industrial and Systems Engineering.
THE UTILITY OF PERIPHERAL VISION TO MOTOR VEHICLE DRIVERS Final Technical Report, 23 Jun. 1975 - 1 Aug. 1977
Thomas H. Rockwell, K. N. Balasubramanian, Tom Kretovics, and Eileen J. Wilfong 1 Aug. 1977 252 p refs
(Contract DOT-HS-5-01203)
(PB-278157/3; DOT-HS-803-244) Avail: NTIS HC A12/MF A01 CSCL 05E

The following topics are considered: (1) determination of the frequency of mirror usage by subjects in traffic maneuvers using their own cars and the associated extent of head turn during mirror usage; (2) the measurement of peripheral detection angles as a function of target contrast, target speed, foveal attentional load, eye and head position, and subject age in a laboratory simulation; and (3) field validation studies. Greater head movement was associated with the left mirror compared to the inside mirror. The percent head turn was 65% for the outside mirror versus 50% for the inside mirror. Age differences were significant with older subjects exhibiting greater head movement for both mirrors. GRA

N78-27780# Michigan Univ., Ann Arbor. Highway Safety Research Inst.
STUDY OF IMPACT TOLERANCE THROUGH FREE-FALL INVESTIGATIONS Final Report, 15 May 1975 - 15 Dec. 1977
Richard G. Snyder, David R. Foust, and Bruce M. Bowman 15 Dec. 1977 313 p refs
(Contract IIHS-6604)
(PB-277537/7; UM-HSRI-77-8) Avail: NTIS

HC A14/MF A01 CSCL 13L

Selected human free-fall impacts and computer simulation of representative falls are studied in order to expand knowledge of human impact tolerance. Of 2100 falls occuring in the U.S. and Canada, 110 cases were selected for on-site investigation of biomedical and biophysical factors. Seven head-first, two side-first, and three feet-first falls were then simulated using the MVMA 2-D Crash Victim Simulator. Children were generally injured less severely than adults under similar fall circumstances, and tended to land on their heads a greater proportion of the time. It was found that survival limits for children may be higher than previously believed. Body position at impact was a major factor in resulting injuries. GRA

N78-28038# Joint Publications Research Service, Arlington, Va.
SPACE SUIT USED ABOARD SALYUT-6 DESCRIBED
G. Ilin and I. Pavlov *In its* Transl. on USSR Sci. and Technol. (JPRS-71393) 30 Jun. 1978 p 34-37 Transl. into ENGLISH from Aviats. Kosmonavt. (Moscow), no. 5, 1978 p 38 (For primary document see N78-28033 18-99)
Copyright. Avail: NTIS HC A05/MF A01

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N78-27781 Stanford Univ., Calif.
THE DESIGN OF TREE AND TRELLIS DATA COMPRESSION SYSTEMS Ph.D. Thesis
Yoseph Linde 1978 142 p
Avail: Univ. Microfilms Order No. 78-08809

Time-invariant tree and trellis codes operating near the rate distortion bound are studied. These codes are data compression systems where the decoder is a time-invariant digital filter and the encoder is a tree or trellis search algotithm matched to the decoder. The plagiarized decoder technique is a data compression scheme where a standard decoder from an existing data compression system is replaced by a more efficient optimal or sub-optimal tree or trellis searcher. The characteristics of fake processes are studied and their performances are evaluated via simulations, for various Gaussian and speech-like (pseudo-voice) signals. The new schemes typically provide 1-2 db improvement in performance over the traditional schemes at a rate of 1 bit/symbol. The inevitable increase in complexity is moderate in most cases. Dissert. Abstr.

N78-27782 Pittsburgh Univ., Pa.
FACTORS IN THE DESIGN OF FILE AND DATA BASE SYSTEMS Ph.D. Thesis
Carol Ann Sledge 1977 236 p
Avail: Univ. Microfilms Order No. 78-09557

The measure of performance is the time required to process a query to the system. Two types of data base systems were studied, a system with an inverted structure and one with a network structure. A simulation model of these systems are constructed and implemented using SIMULA 67. While the model has a number of parameters, this study focused on six: (1) the length of the list of data records associated with a particular access key name and values, (2) the number of these lists associated with the minimal set of access key names and values which describe a particular query to the system, (3) the percentage of the data records on the lists of 2 which satisfy the conditions of the query, (4) the locality of reference for the data records which are retrieved, (5) the size of a data record, and (6) the total number of data records in the system. A rather exhaustive collection of the factors which can affect the performance of a file or data base system is presented. Dissert. Abstr.

N78-27783 British Broadcasting Corp., Kingswood (England). Engineering Div.
CEEFAX: MICROPROCESSOR-BASED CLOCK
J. P. Chambers and J. R. Chew Jun. 1978 10 p
(BBC-RD-1978/18) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

When CEEFAX became a public service it was necessary to provide a dependable source of clock time for transmission as part of the signal. The principles used in the design of the master clock coupled to the CEEFAX computer are described. J.A.M.

N78-27784 California Univ., Davis.
DEVELOPMENT OF A MINICOMPUTER SYSTEM FOR ON-LINE PROCESSING OF GAMMA-GAMMA COINCIDENCE EVENTS AND MEASUREMENTS OF E2/M1 MIXING RATIOS IN Cd-110 AND Ba-134 Ph.D. Thesis
Wayne Delmer Ruhter 1977 167 p
Avail: Univ. Microfilms Order No. 7809252

A megachannel pulse-height analysis system using a 32,000 word PDP-8/E minicomputer and two moving-head disk memories was developed. The system has a storage capacity of 2 to the 18th power events at any of 2 data locations, is capable of processing 1.040 events/s, and provides on-line sorting and disk storage. An X or Y pulse-height spectrum in coincidence with one to four arithmetically combined pulse-height windows can be assembled in core for scope display and spectral analysis within 2 to 20 seconds. The software for the system was written extensively in machine language to provide rapid and efficient data acquisition and sorting, and rapid data recovery from the disk memory by other investigators. The improved resolution and data processing capabilities of this system gave new results for the 563 keV transition in Ba-134 and the 1505 keV transition is Cd-110 E2/M1 mixing ratios of 13.3 + or - superscript 2-3 and suscript 1-8 for the 563 keV transisition and -1.24 + or 1 0.20 for the 1505 keV transition were measured. Dissert. Abstr.

N78-27785# RAND Corp., Santa Monica, Calif.
COMPUTERS AND INFORMATION FLOW
R. L. Patrick Feb. 1978 27 p Revised
(P-2791-4) Avail: NTIS HC A03/MF A01

A general introduction to computers and information systems is summarized, pinning down its unique terminology and jargon, identifying various types of computers and scope of computational capabilities, and providing some rules of thumb which can be applied in determining whether a need for such a capability exists or not. J.A.M.

N78-27786# Battelle Pacific Northwest Labs., Richland, Wash.
CALCULATION OF POPULATION DISTRIBUTION USING A COMPUTER DATA BASE
E. R. Hill Aug. 1977 10 p refs
(Contract EY-76-C-06-1830)
(BNWL-2395) Avail: NTIS HC A02/MF A01

The program and data base were developed primarily for marketing purposes. The EPA subsequently adapted them for use in population exposure problems. The program was used to study populations in the neighborhood of reactors. The output

was aggregated for each reactor location and then introduced to other computer programs for additional calculations. In this study, the distributions were obtained for 10 concentric annuli within 80 km of the reactor sites. The annuli were divided into sixteen sectors centered on points of the compass. The population data base is an edited and compressed version of the 1970 U.S. Census Bureau's Master Enumeration District List with Coordinates. It consists of approximately 250,000 records, each of which represents a census enumeration district (CED). Each record contains the geographic coordinates of the population centroid for the district, population and housing counts, state and county codes. ERA

N78-27787# Stanford Linear Accelerator Center, Calif.
FASTBUS: STATUS OF DEVELOPMENT OF A STANDARD HIGH SPEED DATA ACQUISITION BUS FOR HIGH ENERGY PHYSICS
R. S. Larsen Nov. 1977 5 p refs Presented at the Nucl. Sci. Symp., San Francisco, 19-21 Oct. 1977
(Contract EY-76-S-03-0326)
(SLAC-PUB-2037; Conf-771023-35) Avail: NTIS HC A02/MF A01

In late 1975 the US NIM Committee initiated a study group, known as the Advanced System Study Group, to review the future data acquisition modular interface requirements for high-energy physics. The final report of this group recommended the development of a new standard system, now known as "FASTBUS," which would have as principal features improved speed by a factor of 10 over CAMAC, more generalized architecture to accommodate distributed parallel processing and fast preprocessing, special scan modes of particular use in high-energy particle detection systems, and standardized bus structures and mechanics. ERA

N78-27788# Los Alamos Scientific Lab., N. Mex.
CAD-CAM INTERACTIVE GRAPHICS SYSTEM DESIGNED BY USERS
D. J. Lauer 1978 20 p Presented at the 15th Ann. Numerical Control Conf., Chicago, 9-12 Apr. 1978
(Contract W-7405-eng-36)
(LA-UR-78-179; Conf-780411-1) Avail: NTIS HC A02/MF A01

An interactive graphics system was specified and developed to integrate design, drafting, testing, analysis, and manufacturing operations to achieve efficient and effective laboratory-wide services. To accomplish this, the graphics system is hardware independent and has an associative data base structured on two- and three-dimensional, bounded geometry. The data base allows for levels of attributes that can be attached or deleted and interrogated. This graphics system is described with emphasis on its capability and efficiencies and the effect of the associative data base on the design--build--test cycle. The capability of attaching attributes is explored as the means of comminicating the design and manufacturing data base to the management data base. The graphic system is shown to be cost effective for the big as well as small user. ERA

N78-27789# Los Alamos Scientific Lab., N. Mex.
COMPUTER GENERATED MOVIES AS AN ANALYTIC TOOL
R. L. Elliott 1978 6 p Presented at the 11th Symp. on the Interface of Computer Sci. and Statistics, Raleigh, N.C., 6 Mar. 1978
(Contract W-7405-eng-36)
(LA-UR-78-66; Conf-780317-1) Avail: NTIS HC A02/MF A01

One of the problems faced by the users of large, sophisticated modeling programs is the analysis of the results of their calculations. One of the more productive and frequently spectacular methods is the production of computer generated movies. An overview of the generation of computer movies is presented. The hardward, software, and generation techniques are briefly discussed. ERA

N78-27790# Sandia Labs., Albuquerque, N. Mex. Design and Development Div.
DIGITAL DATA ACQUISITION AND ANALYSIS SYSTEM FOR THE 8.8 AND 10.7 METER CENTRIFUGAL FACILITIES: SYSTEM CAPABILITIES REPORT
Robert N. Tomlinson Jan. 1978 33 p
(Contract EY-76-C-04-0789)
(SAND-77-1502) Avail: NTIS HC A03/MF A01

The capabilities of a minicomputer controlled data acquisition and analysis system for the Area II centrifuge facility are described. The system utilizes a PCM encoder for on-board signal digitizing and a magnetic disc for data storage. Report quality plots are available immediately at the conclusion of a test from the CRT graphics terminal and hardcopy unit. Program software is written in Fortran and assembly language. ERA

N78-27791# Los Alamos Scientific Lab., N. Mex.
DATA-BASE MANAGEMENT SYSTEM FOR SPATIAL DISPLAY OF FEDERAL OFFSHORE OIL AND GAS LEASE DATA
J. L. Sibert, Richard Phillips, and John Lohrenz 1978 12 p refs Presented at the 2d Geol. Surv. Computer Symp., Reston, Va., 22 Mar. 1978
(Contract W-7405-eng-36)
(LA-UR-77-2779; Conf-780311-1) HC A02/MF A01

A data-base management system that meets requirements for color-coded map displays and is used for Federal offshore oil and gas lease data of the LPR-5 and LPR-10 data bases is described. The data base is accessed using a powerful and easily learned query language that resembles simple English. Data base searches may be keyed on either data items or functions of data items. For example, all leases that are produced at flush level can be located with one simple query. Provision is made for graphical output, including production of high-quality color maps. The data base has a network structure however; the user need not be aware of the structure to query the data base. Examples are provided of several different types of queries and the resulting output. ERA

N78-27792# National Bureau of Standards, Washington, D. C. Systems and Software Div.
COMPUTER SCIENCE AND TECHNOLOGY: DATABASE ADMINISTRATION: CONCEPTS, TOOLS, EXPERIENCES, AND PROBLEMS
Belkis Leong-Hong and Beatrice Marron Mar. 1978 52 p
(PB-278664/8; NBS-SP-500-28; LC-78-606197) Avail: NTIS HC A04/MF A01 CSCL 09B

The concepts of database administration, the role of the database administrator (DBA), and computer software tools useful in database administration are described in order to assist database technologists and managers. A study of DBA's in the Federal Government is detailed in terms of the functions they perform, the software tools they use, the problems they have encountered, and advice they offer. Finally, some guidelines are presented on what database administration should do for management, and what management must do for their DBA's. GRA

N78-27793# National Cancer Inst., Bethesda, Md. Image Processing Unit.
BMON2-BUFFER MEMORY MONITOR SYSTEM FOR INTERACTIVE IMAGE PROCESSING Final Technical Report
Peter Lemkin 17 Mar. 1978 120 p refs
(PB-278789/3; NCI/IP-78/01) Avail: NTIS HC A06/MF A01 CSCL 09B

BMON2 is a PDP8e image processing system running on the Image Processing Unit's Real Time Picture Processor (RTPP) used for biological image processing. The RTTP consists of a PDP8e computer, Quantimet 720 TV image analyzer, Axiomat microscope with stage, focus and zoom stepping motor control, interactive control desk, GraphPen Tablet, and image buffer memory. Control of the system is effected by interaction through the teletype commands or control desk. Teletype commands are entered via the OS8 command decoder (with the implication that BMON2 may be run under OS8 BATCH). About 100 operations are available. Results are converted to microns for use convenience. Teletype commands may be dynamically assigned to the 12 command keys on the desk which may be saved and restored from disk files. This allows individually selected sub sets of BMON2 commands to be called directly from the control desk. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N78-27794 Case Western Reserve Univ., Cleveland, Ohio.
A SYNTAX DIRECTED VERIFICATION SYSTEM Ph.D. Thesis
Jainendra Kumar Navlakha 1978 170 p
Avail: Univ. Microfilms Order No. 78-09295

A Hoare-type axiomatic approach is used to describe the rules of inference of a large subset of procedure oriented language. New programming language statements, ASSUME and CONFIRM, are introduced which allow the programmer to specify assertions as part of his program. Proof rules are given for declaring and calling procedures which have parameters of the type procedure. The rules of inference are comprehensible in the sense that a human can understand their meaning without much difficulty, mechanical in the way that they are used to generate verification conditions, and comprehensive in the sense that the languages have most of the structured programming constructs. Formal interpretive denotational semantics are used to establish the logical consistency of system. Dissert. Abstr.

N78-27795 Kansas Univ., Lawrence.
N-SPEED HOMOMORPHISMS AND SIMULATIONS AND PARALLEL STATES Ph.D. Thesis
Leonard Darrell Myers 1977 241 p
Avail: Univ. Microfilms Order No. 78-09373

Machine simulations and automata homomorphisms are determined in such a manner as to allow their specification by computer programs. N-speed homomorphisms and simulations of automata and machines are defined. In either a homomorphism or a simulation the image structure is allowed to run at N times the speed of the original. The practical implications of the new definitions are discussed and algorithms for finding N-speed homomorphisms and simulations are developed. Programs written in PL/C implement the algorithms and attest to their practicality. The quality of the presentation style for the algorithms is discussed in relation to the ease and correctness of the programs. Auxiliary study involves the new concepts of parallel states and unimorphous automata. Unimorphous automata are defined as automata that have trivial automorphism group on each of their homomorphic image automata. Dissert. Abstr.

N78-27796 Stanford Univ., Calif.
HIERARCHICAL PROPERTIES OF FLOWS, AND THE DETERMINATION OF INNER LOOPS Ph.D. Thesis
Bernard Marcel Mont-Reynaud 1978 165 p
Avail: Univ. Microfilms Order No. 78-08815

A typical program, when executed on a typical large input, spends most of its time executing a comparatively small number of statements -- the statements of its inner loops. The determination of inner loops, and more generally, of the dynamic loop structure of a program, is of primary importance in compiler optimization. The fundamental notions of inner loop and dynamic loop structure can be defined rigorously. To the asymptotic behavior of a program corresponds a hierarchy of nested loops, derived from the relation much less than in the program graph; u much less than v if u is executed infinitely less often than v, in the limit as the size of the input to the program grows indefinitely. This construction applied to the average or worst-case behavior of an arbitrary program; it can be simplified when the program behavior satisfies a certain stability condition, which is almost always met in practice. Dissert. Abstr.

N78-27797 Brown Univ., Providence, R. I.
A MODEL FOR PROGRAM OPTIMIZATION Ph.D. Thesis
Kenneth I. Magel 1977 329 p
Avail: Univ. Microfilms Order No. 78-09074

A model for describing, classifying, and evaluating the effects of program optimization algorithms is developed. This model encompasses the following six kinds of entities: (1) programs which are the objects of optimization; (2) program executions which indicate the effects of optimization; (3) cost functions which determine what is and what is not an optimization; (4) transformations of parts of programs which are candidates for being optimizations, (5) translation which is the process during which optimizations are attempted; and (6) algorithms for actually performing optimizations. The model uses the Vienna definition language to describe programs and program executions. Translation is a mapping from a source program to a target program which can be decomposed into a sequence of applications of specific transformations. Some of these transformations realize the basic translation from source language to target language. Dissert. Abstr.

N78-27798 Pennsylvania State Univ., University Park.
COMPUTATIONS WITH A RESTRICTED NUMBER OF NONDETERMINISTIC STEPS Ph.D. Thesis
Chandra Mohan Rao Kintala 1977 99 p
Avail: Univ. Microfilms Order No. 78-08381

The concept of nondeterminism as an additional resource at the disposal of certain recursive classes of machines and the relationships among the various classes of languages acceptable by such machines with restricted amounts of nondeterminism are investigated. For any given recursive functions the class of languages acceptable by t(n)-time bounded turing machines is denoted making at most g(n) nondeterministic moves on inputs of length n. Then the infinite hierarchy of classes of realtime languages is established. Dissert. Abstr.

N78-27799 Wisconsin Univ. - Madison.
SPECIFICATIONS AND RATIONALE FOR TELOS, A PASCAL BASED ARTIFICIAL INTELLIGENCE PROGRAMMING LANGUAGE Ph.D. Thesis
Richard Joseph Leblanc, Jr. 1977 182 p
Avail: Univ. Microfilms Order No. 78-04867

A programming language called TELOS is introduced through a complete specification of its syntax and an informal description of its semantics. The design of TELOS is discussed in view of a set of language design goals and the needs of artificial intelligence (AI) programming. TELOS is an attempt to provide powerful abstraction mechanisms and other structuring facilities within a language that provides the special capabilities needed for AI research. Like most other AI languages, TELOS includes facilities needed for experimentation with large stores of general knowledge, tentatively modifiable and associatively referencable, and with various planning and reasoning strategies. However, in contrast to other AI languages whose design has focused on building in certain powerful high-level constructs, the design of TELOS has focused on building in powerful abstraction mechanisms with which these particular high-level constructs, as well as numerous others, can be defined and implemented with reasonable ease. Dissert. Abstr.

N78-27800 Clemson Univ., S.C.
A PROGRAMMING THEORY FOR CONTINUOUS-DISCRETE HYBRID SIMULATION Ph.D. Thesis
George Thomas Mertens 1977 78 p
Avail: Univ. Microfilms Order No. 78-08588

Problems encountered in what will be called continuous-discrete hybrid simulation are addressed. Definitions are given to make the distinction between this type of simulation and the other types (continuous and discrete) completely clear. The difficulties encountered in hybrid simulation are discussed and then a programming theory to handle these difficulties is presented. This programming takes the form of a product automaton performing data processing on a data structure. Detailed descriptions are given of the states and state transformations of the automata along with the required data structures. Dissert. Abstr.

N78-27801# National Bureau of Standards, Washington, D. C. Applied Mathematics Div.
COMPUTERS AND MATHEMATICAL PROGRAMMING: PROCEEDINGS OF THE BICENTENNIAL CONFERENCE ON MATHEMATICAL PROGRAMMING Final Report
William W. White (IBM Corp., Poughkeepsie, New York) Feb. 1978 387 p Conf. Held at Gaithersburg, Md., 29 Nov. - 1 Dec. 1976 Sponsored in Part by Assoc. of Computing Machinery, New York
(PB-278613/5; NBS-SP-502; LC-77-600065) Avail: NTIS HC A17/MF A01 CSCL 09B

The Bicentennial Conference on Mathematical Programming,

examined the relationship between solving systems-capabilities and structure; Software development; Operational management. GRA

N78-27802# Electronic Systems Div., L. G. Hanscom Field, Mass.
A COMPUTERIZED MODEL FOR ESTIMATING SOFTWARE LIFE CYCLE COSTS MODEL CONCEPT, VOLUME 1
Gerard A. Bourdon and Joseph A. Duquette Apr. 1978 28 p refs
(AD-A053937; ESD-TR-77-235-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report is the first volume of a series of reports on the development of a computerized model for estimating software life cycle costs. This volume deals with the basic concepts of the model. The report defines the basic stages of the model, the methodologies employed, and the desired features of the model. The report contains enough information to allow operation of the model by manual methods. Author (GRA)

N78-27803# California Univ., Santa Cruz. Information Sciences.
PRACTICAL ERROR RECOVERY FOR LR PARSERS
Thomas J. Pennello and Frank Deremer Dec. 1977 49 p refs
(Contract N00014-76-C-0682)
(AD-A053961; TR-78-1-002) Avail: NTIS HC A03/MF A01 CSCL 09/2

A 'forward move algorithm' and some of its formal properties are presented for use in a practical syntactic error recovery scheme for LR parsers. The algorithm finds a 'valid fragment' (comparable to a valid prefix) just to the right of a point of error detection. For expositional purposes the algorithm is presented as parsing arbitrarily far beyond the point of error detection in a 'parallel' mode, as long as all parses agree on the read or reduce action to be taken at each parse step. In practice the forward move is achieved serially by adding 'recovery states' to the LR machine. Based on the formal properties of the forward move we propose a practical error recovery algorithm that uses the 'right context' accumulated by the forward move. The performance of the recovery algorithm is illustrated in a specific case and discussed in general. Author (GRA)

N78-27804# Sandia Labs., Albuquerque, N. Mex.
INSTALLATION INDEPENDENT VERSION OF THE SANDIA SCORS PLOT SYSTEM
S. L. Thompson and N. K. Ruiz Jan. 1978 35 p ref
(Contract EY-76-C-04-0789)
(SAND-77-1179) Avail: NTIS HC A03/MF A01

A portable version of the Sandia SCORS plot system is described. The set of computer routines is designed to accompany Sandia programs sent outside of the laboratory, and can generate output for any type of plotter that might be available. ERA

N78-27805# Sandia Labs., Albuquerque, N. Mex.
SOFTWARE DEVELOPMENT OF A REAL TIME SIGNAL PROCESSING SYSTEM
Nolan A. Bourgeois, Jr. 1977 66 p refs Presented at the Digital Signal Processing Symp., Albuquerque, N. Mex., 6 Dec. 1977 Sponsored in part by AFSC
(Contract EY-76-C-04-0789)
(SAND-77-1684C; Conf-771206-3) Avail: NTIS HC A04/MF A01

A method of developing real time signal processing assembly language code is described. The technique presented includes the use of fixed point arithmetic. A sample program of a real time nonrecursive adaptive filter followed by an averaging detector is also included. ERA

N78-27806# Sandia Labs., Albuquerque, N. Mex. Computer Aided Systems Development Div.
SOFTWARE DOCUMENTATION GUIDELINES AND PROCEDURES FOR APPLICON SYSTEMS
William C. Burd, Gino Carli, and Ann L. Yates Jan. 1978 30 p refs
(Contract EY-76-C-04-0789)
(SAND-77-1831) Avail: NTIS HC A03/MF A01

Proper documentation and adequate backup procedures for Applicon-supplied and Department 9620-developed Applicon software is required to insure the security and reliability of computer code in which substantial investment has been made. This report describes the requirements, responsibility, and procedures which were established to provide this protection. ERA

N78-27807# Battelle Pacific Northwest Labs., Richland, Wash.
NEWCAS: AN INTERACTIVE COMPUTER PROGRAM FOR PARTICLE SIZE ANALYSIS
M. A. Hill, C. R. Watson, and O. R. Moss Dec. 1977 76 p ref
(Contract EY-76-C-06-1830)
(PNL-2405) Avail: NTIS HC A05/MF A01

A FORTRAN program (NEWCAS) executable on PDP 11/70, was used to calculate the respirable fraction of aerosols from cascade impactor data. This report describes how NEWCAS works and how to use it. Included is a complete program listing. A novel feature of the program is the method used to display a log-normal probability plot on an ordinary (non-graphics) computer terminal. Calculations are independent of how the stage activity is measured. NEWCAS always assumes a log-normal distribution. ERA

N78-27808# Sandia Labs., Albuquerque, N. Mex. Computer Aids System Development Div.
USER/PROGRAMMER GUIDE FOR UCMD 85
Donald K. Robbins Jan. 1978 17 p refs
(Contract EY-76-C-04-0789)
(SAND-77-1683) Avail: NTIS HC A02/MF A01

Program UCMD 85 an Applicon AGS/870 user command for extracting a MACRO from a file drawing and appending it to a drawing on the table, nondialogue version is described.ERA

N78-27809# Sandia Labs., Albuquerque, N. Mex.
AMOSLIB: A SPECIAL FUNCTION LIBRARY VERSION 9/77
Donald E. Amos and Sharon L. Daniel Sep. 1977 80 p
(Contract EY-76-C-04-0789)
(SAND-77-1390) Avail: NTIS HC A05/MF A01

The call list and parameter definitions for 59 computer codes dealing with Bessel functions, error functions, gamma functions, beta functions, sine and cosine integrals, root solvers, statistical distributions, etc are given. The following codes are included: AIRY, DAIRY, BAIRY, DBAIRY, BESJ01, BESI01, BESY01, BESK01, BESJ, BESI, SBESI, BESYN, BESKN, BERBEI, KRKI, DKRKI, CJ01BS, CJYHBS, JROOTS, FINTK0, ERF, ERFC, RERF, CERF, INERFC, RIERFC, GAMLN, GAMFN, GAMIC, GAMTL, BETALN, BETAIC, BETBIC, SININT, COSINT, XNEWT, FINVER, FNORM, RVNORM, FNORMB, FCHISQ, FNCH12, FCENT, FNCT, FDNCT, FBIVTS, FBIVTQ, FMLTVT, FFDIST, FNCF, FNCFQ, FMLTVF, FCIRCV, THA, GAUS8, DATAD, ERRCHK, ONECHK, and ERXSET. Author (ERA)

N78-27810# Sandia Labs., Albuquerque, N. Mex.
SELECTED ALGORITHMS FOR LEAST SQUARES COMPUTATIONS: A USER'S GUIDE
Richard J. Hanson Mar. 1978 55 p refs
(Contract EY-76-C-04-0789)
(SAND-77-1090) Avail: NTIS HC A04/MF A01

A list of high-quality software, is given. Six commonly occurring computational problems are illustrated by the inclusion of FORTRAN programs that utilize an appropriate FORTRAN subprogram of this list. These problems are identified as standard usage, sequential accumulation, normal equations, equality and inequality constraints, constrained curve fitting by a cubic polynomial, and ill-posed problems. Other problem areas discussed are identified as formulating curve fitting problems, problems with many columns, and banded least sequares problems. ERA

N78-27811# Sandia Labs., Albuquerque, N. Mex.
USER/PROGRAMMER GUIDE FOR UCMD 84: EDIT OF A MACRO FOR A DRAWING ON THE TABLE
D. K. Robbins Feb. 1978 20 p refs
(Contract EY-76-C-04-0789)
(SAND-77-1054) Avail: NTIS HC A02/MF A01

A description is given of a program UCMD 84--an Applicon

AGS/870 User Command for editing a MACRO using the HP 2644/5 and returning it to the drawing on the table. ERA

N78-27812# Sandia Labs., Albuquerque, N. Mex.
USER/PROGRAMMER GUIDE FOR UCMD 88: STORE USER DICTIONARY
N. J. Nelson Dec 1977 14 p refs
(Contract EY-76-C-04-0789)
(SAND-77-1798) Avail: NTIS HC A02/MF A01

A description is given of program UCMD88--an Applicon AGS/870 User Command to store the dictionary from a drawing file loaded on the table to a file called USERDIC created in the user's area. ERA

N78-27813# Bendix Corp., Kansas City, Mo.
SIMULATION MODELING OF AN AUTOMATED MATERIAL STORAGE/RETRIEVAL SYSTEM
J. Gallegos Mar. 1978 43 p refs
(Contract EY-76-C-04-0613)
(BDX-613-1870) Avail: NTIS HC A03/MF A01

A computer simulation model is presented for an automated material storage and retrieval system that utilizes bin loading. The model is written in General Purpose Simulation System (GPSS) language, and it functionally simulates incoming job arrival rates, operator task times, and the travel times of the storage/retrieval vehicle. The model is utilized to evaluate the impact of employing different types of storage policies, the duration of wait times encountered in a priority batch queue, and the expected throughput capacity of the system under either maximum input or peak period conditions. ERA

N78-27814# Los Alamos Scientific Lab., N. Mex. Theoretical Div.
TRIDENT: A NEW TRIANGULAR MESH DISCRETE ORDINATES CODE
T. J. Seed, W. F. Miller, Jr., and G. E. Bosler 1978 6 p refs Presented at Topical Meeting on Advan. in Reactor Phys., Gatlinburg, Tenn., 9-12 Apr. 1978
(Contract W-7405-eng-36)
(LA-UR-77-2511; Conf-780401-1) Avail: NTIS HC A02/MF A01

The TRIDENT computer code solves the two-dimensional static, multigroup neutron transport equation in x-y and r-z geometries within a general domain having material boundaries that are not necessarily parallel to coordinate axes. The spatial discretization is accomplished using triangular finite elements and piecewise linear trial functions. The x-y geometry triangles allow the user to accurately model hexagonal lattices, square cells containing circular rods, and complicated shield configurations. With r-z geometry triangles, toroidal geometry problems of importance to Tokamak designs can be solved even for cases of elliptic or general irregular cross sections. The r-z geometry triangles are also useful for modeling complicated cylindrical shield configurations. An additional feature of TRIDENT is an option to mitigate or, if desired by the user, eliminate the ray effect. ERA

N78-27815# Oak Ridge National Lab., Tenn.
USER'S INSTRUCTIONS FOR PRELIMINARY VERSION OF THE CONCEPT-5 COMPUTER CODE
C. R. Hudson, II 26 Jan. 1978 57 p refs
(Contract W-7405-eng-26)
(ORNL-TM-6230) Avail: NTIS HC A04/MF A01

In an effort to increase user flexibility and produce more accurate conceptual cost estimates of electric power generating plants, the CONCEPT-5 computer program package was prepared. Delays in acquiring certain cost data necessitate the release of a preliminary version of the CONCEPT-5 code. By doing so, new cost data already available may be utilized until a final version is issued. Instructions are given on loading the programs into the computer, a description of the cost models presently available, input requirements and operating features, and example cases. It is assumed that the reader has familiarity with the prior version of the code described in ERDA-108. ERA

N78-27816# National Oceanic and Atmospheric Administration, Rockville, Md. Office of Management and Computer Systems
FAST FORTRAN AND DIRECT ACCESS I/O PACKAGE, USER'S GUIDE
Donald Flanders Jan. 1978 20 p
(PB-278005/4; NOAA-DF-78-001a) Avail: NTIS CSCL 09B

A package of I/O routines for sequential access to tape or disc using IBM's Qsam is considered. It allows the user from inside a program to read, read backwards, write, rewind, unload, position to different files, change tapes, and access different members of a partitioned dataset. It allows rapid access to both tape and disc, as well as I/O to multifile tapes, members of partitioned datasets and multiple tapes from within a user program with a minimal number of DD cards required. It contains I/O routines for random access using channel programs, allowing blocking of the records. The encode and decode routines allow rapid conversion between EBCDIC characters and internal IBM representation. GRA

N78-27817# California Univ., Davis. Public Policy Research Organization and Graduate School of Administration.
DIFFUSION AND ADOPTION OF COMPUTER APPLICATIONS SOFTWARE IN LOCAL GOVERNMENTS Final Report
James L. Perry and Kenneth L. Kraemer Jan. 1978 238 p refs
(Contract NSF PRA-76-15549)
(PB-279059/0; NSF/PRA-7615549/2/8) Avail: NTIS HC A11/MF A01 CSCL 05A

By exploring the structures and decisions underlying innovation diffusion and adoption, this study seeks to identify variables that influence innovation and to provide a basis for understanding the effects of public and private involvement. Through these efforts, the study aims to develop a better understanding of the interrelated activities that produce technological innovations and that lead to their applications; and thus, to enable public and private policymakers to improve the timeliness, extent, and effectiveness of government and industry involvement in innovation. The report deals with a particular class of organizational units, American local governments, and a particular class of technological innovations, the application of computers to local government activities. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N78-27818 Duke Univ., Durham, N. C.
EQN MODELS FOR THE ANALYSIS AND DESIGN OF A COMPUTER NETWORK OF FUNCTIONALIZED PROCESSORS Ph.D. Thesis
Robert Leland Leech 1977 199 p
Avail: Univ. Microfilms Order No. 78-07612

The network queuing theory is used to establish three Exponential Queueing Network (EQN) models of computer network systems. A projected computer network is based on the specification of processing functions for model representation. Example functions used in this work are computation, data base management, communications and terminal/access interface as would be applicable to a military command and control computer system. The models may be used for trade-off analysis of critical performance criteria. Additionally, a basic method for the synthesis/determination (design) of processor computer power to ensure a load balanced network is ascertained. The three models and their respective computer network evaluations for trade-off analysis are pursued with their inherent advantages and disadvantages. Additionally, these models are compared with a classical event driven simulation in order to demonstrate their internal consistency and to provide a basis for verification.
Dissert. Abstr.

N78-27819# California Univ., Los Angeles. Graduate School of Management.
ANNUAL REPORT FOR THE PERIOD 1 APRIL 1977 THROUGH 31 MARCH 1978
Bennet P. Lientz 15 Mar. 1978 12 p refs
(Contract N00014-75-C-0266; NR Proj. 049-345)
(AD-A053803) Avail: NTIS HC A02/MF A01 CSCL 09/2

The first report presented a life cycle model for the usage of a computer network from a user's point of view. The model

was developed after a survey of several networks user organizations. Another report in the area of computer network is the fourth report. This report presents trade-off analysis to determined under what levels of degradation economies of scale of centralized facilities are compromised when a part of the workload is secure. A third paper deals with the construction of peak load pricing models. The work is based in part on previous work in the electric utility industry. GRA

N78-27820# California Univ., Livermore. Lawrence Livermore Lab.
END-TO-END PROTOCOL DESIGN ISSUES FOR A LOCAL COMPUTER NETWORK: THE DELTA t MECHANISM
R. W. Watson and J. G. Fletcher 20 Dec. 1977 19 p refs Presented at the 2d Univ. of Minnesota Conf. on Local Computer Networks, Minneapolis, 12-14 Oct. 1977
(Contract W-7405-eng-48)
(UCRL-80471; Conf-7710117-1) Avail: NTIS HC A02/MF A01

Environmental assumptions and the major issues in network protocol design, such as network protocol addressing, assurance, and efficiency, for an end-to-end (process-to-process) protocol for a local computer network are discussed. Assurance issues are discussed in detail. Single-message applications and message stream or logical (virtual) circuits are important in a high bandwidth, low delay local network. Emphasis is on a timer-based mechanism for reliable, efficient transmission of both single-message and message stream traffic. Correct data delivery is assured in the face of lost, damaged, duplicate, and out of sequence packets. Current reliable approaches to protocol design are not well suited for single message modes of communication appropriate, for example, to distributed network operating systems. The timer intervals that must be maintained for sender and receiver are developed, along with the rules for timer operation, packet acceptance, packet creation, and connection opening and closing. ERA

N78-27821# Purdue Univ., Lafayette, Ind. Lab. for Applied Industrial Control.
ANALYSIS OF FAULT DETECTION, CORRECTION, AND PREVENTION IN INDUSTRIAL COMPUTER SYSTEMS
Eric J. Schaffer and Theodore J. Williams Oct. 1977 156 p refs
(Grant NSF APR-73-07822)
(PB-278880/0; NSF/RA-770350; Rept-106) Avail: NTIS HC A08/MF A01 CSCL 09B

Research is concerned with three fault-tolerant computer methods for meeting reliability requirements: (1) hardware redundancy is defined as any circuitry in the system not necessary for normal computer operation should no faults occur; (2) software redundancy is defined as additional program instructions present solely to handle faults; and (3) time redundancy is defined as any retrial of instructions. In order to provide an understanding of the fault-tolerant methods under study examples of their uses and limitations are presented. Hardware aspects of coding and modular redundancy are discussed. Discussions of software include means of protection, detection, and correction of software faults through software as well as software methods to handle hardware errors. Finally, duplex and triplex fault-tolerant industrial computer systems are discussed that may be built from conventional computers with little or no need for expensive additional hardware. GRA

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

N78-27822 Virginia Polytechnic Inst. and State Univ., Blacksburg.
PATTERN SYNTHESIS AND PERTURBATION IN TESSELLATION AUTOMATA Ph.D. Thesis
Stephen Madison Walters 1977 164 p
Avail: Univ. Microfilms Order No. 78-08123

Following a brief introduction to cellular automata, the formal motion of tessellation automata is advanced and a cellular computer using them is described. Potentially, this computer has the ability to do self-diagnosis and self-reconfiguration for internal faults without external assistance. Next, computational equivalence of turing machines and tessellation automata is demonstrated. This shows the powerful nature of tessellation automata. The existence of cyclic patterns with unique subpatterns is proven. Results which find the relation between growth rate and neighborhood index are then obtained and a solution to the synthesis problem is found. This demonstrates the existence of a local transformation whereby a given configuration can be generated from a single seed in the automation. Dissert. Abstr.

N78-27823 Case Western Reserve Univ., Cleveland, Ohio.
A GEOMETRIC APPROACH TO THE OPTIMAL CONTROL OF A CLASS OF BILINEAR SYSTEMS Ph.D. Thesis
Abraham Schwrtzun Sharon 1978 147 p
Avail: Univ. Microfilms Order No. 78-09298

Bilinear control systems which have the state spaces that are group manifolds or coset spaces are investigated. The particular focus is on a class of bilinear systems for which the state space is the special orthogonal group or the n-dimensional sphere. Explicit optimal control algorithms are developed by exploiting the geometric structure of the state space. The study employs lie algebraic methods in optimal control theory via the maximum principle and the calculus of variations. The methods of this study are applied to the problem of controlling the orientation of a space vehicle while minimizing certain performance measures, such as response time and fuel consumption. Closed form solutions were obtained. Dissert. Abstr.

N78-27824# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
CONTROL OF DYNAMICAL SYSTEMS Semiannual Progress Report, 1 Sep. 1977 - 1 Mar. 1978
H. T. Banks, J. K. Hale, and J. P. LaSalle 27 Mar. 1978 27 p refs
(Grant AF-AFOSR-3092-76)
(AD-A053736; AFOSR-78-0750TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

During the referenced period of the grant 13 publications were prepared. The papers deal with numerical methods for optimal control of equations with delays, optimal control of diffusion-reaction systems, nonlinear oscillations quatitative theory for ordinary and partial differential equations, and control systems. For additional details refer to the work unit file for the referenced grant. Author (GRA)

N78-27825# Naval Research Lab., Washington, D. C. Space Research Div.
DIGITAL IMAGE PROCESSING BY USE OF LOCAL STATISTICS Final Report
Jong-Sen Lee 1 Mar. 1978 14 p refs
(RR0140241)
(AD-A053843; AD-E000139; NRL-8192) Avail: NTIS HC A02/MF A01 CSCL 05/8

Computational techniques involving contrast enhancement and noise filtering on two-dimensional image arrays were developed, based on their local mean and variance. These algorithms are nonrecursive and do not require a transform. They share the same characteristics in that each pixel is processed independently. Consequently, this approach has an obvious advantage when used in real-time digital image processing applications and where parallel processors can be used. For both the additive and multiplicative cases, the a priori mean and variance of each pixel is derived from its local mean and variance. Then, the minimum mean-square-error estimator in its simplest form is applied to obtain the noise-filtering algorithms. For multiplicative noise a statistical optimal linear approximation is made. Experimental results show that such an assumption yields a very effective filtering algorithm. Examples on images containing 256 x 256 pixels are given. Results show that in most cases the techniques developed in this report are readily adaptable to real-time image processing. Author (GRA)

N78-27826# Naval Postgraduate School, Monterey, Calif.
A BRIEF SURVEY OF ADAPTIVE CONTROL SYSTEMS Final Report, May 1977 - Mar. 1978
Mar. 1978 31 p refs

(AD-A053837; NPS62-78-003) Avail: NTIS HC A03/MF A01 CSCL 14/2

This document summarizes the principles of adaptive control systems and suggests a number of possible uses of this new technology on acoustic tracking ranges. A bibliography of recent literature is included. Author (GRA)

N78-27827# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
UNDERSTANDING HAND-PRINTED ALGEBRA FOR COMPUTER TUTORING
Stephen C. Purcell Dec. 1977 71 p refs
(Contracts MDA903-76-C-0108; N00014-75-C-0643)
(AD-A053805; BBN-3749; ICAI-9) Avail: NTIS HC A04/MF A01 CSCL 09/2

This thesis demonstrates how the use of a global context can improve the power of a local character recognizer. The global context considered is a computer tutor of high school algebra that observes a student working algebra problems on a graphics tablet. The tutoring system is integrated with a character recognizer to understand the pen strokes of an algebra solution coming from the computer tablet. A tablet based input understander for an algebra tutoring system is designed and implemented. This thesis joins together two uses of a computer, intelligent tutoring, and tablet communication. Natural communication with computers has been pursued through speech understanding, English text understanding, special purpose languages, hand printing, and graphics. This work extends the power of hand-printing understanders by using more varied and higher level sources of knowledge than have been used previously. Author (GRA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N78-27828 Princeton Univ., N. J.
NUMERICAL SOLUTION OF STIFF DIFFERENTIAL SYSTEMS Ph.D. Thesis
Ian Yau Nam Chan 1978 239 p
Avail: Univ. Microfilms Order No. 7807464

The recognition of the significance of stiff differential equations has led to the proposal of a great number of new methods in recent years. An attempt is made here to systematically categorize the methods according to their class as well as their approach in tackling the problem of stiffness. By numerically testing representative algorithms from different classes, the semi-implicit Runge Jutta methods appear to be extremely efficient and simple to use. The development of this class of method into a variable step-size algorithm by using an imbedded technique is presented. Extensive numerical tests on systems with stiffness ratio as high as 10 to the 16th power further demonstrated the method to be competitive with all other proposed algorithms. Dissert. Abstr.

N78-27829 Massachusetts Univ., Amherst.
AN ALGEBRAIC DESCRIPTION AND SYNDROME DECODING FOR RATE 1/n CONVOLUTIONAL CODES Ph.D. Thesis
DevVrat Gupta 1977 198 p
Avail: Univ. Microfilms Order No. 77-30553

An algebraic theory was developed for rate 1/n convolutional codes over GF(q). A two dimensional syndrome definition for this class of codes is described as well as a technique for obtaining the minimal encoder that will generate a given rate 1/n convolutional code. The syndrome definition is used to develop maximum likelihood decoding schemes for rate 1/n binary convolutional codes when the code being used is terminated after k+1 information digits, and transmission is over a binary symmetric channel. Algebraic maximum likelihood syndrome decoding is discussed for a class of quotient decodable rate 1/2 convolutional codes. The feasibility of algebraic sequential coding is demonstrated for general rate 1/n finitely terminated convolutional codes. Expressions are derived for the bit error and word error probability of linear, binary group codes using the decoding table approach. Dissert. Abstr.

N78-27830 Kansas Univ., Lawrence.
SUBPROJECTABLE AND LOCALLY FLAT LATTICE-ORDERED GROUPS Ph.D. Thesis
Marlow Edward Anderson 1977 100 p
Avail: Univ. Microfilms Order No. 78-09330

The preservation of various projectability properties of lambda groups under complete lambda homomorphic images. Strong projectability is shown to be preserved while projectability is not. A weakened projectability property called subprojectability is introduced and its preservation by complete lambda homomorphic images is demonstrated. Archimedean lambda groups which have a collection of minimal and maximal primes whose intersection is zero (locally flat) are studied. The notion of phi-extension of a locally flat lambda group is introduced. With an appropriate definition, each locally flat lambda group unit admits a unique phi-closure, which is in some sense a maximal phi-extension. It is of the form F(X), for an extremely disconnected Tychonoff space X. The relationship between local flatness and lateral completeness is discussed. The application of the theory of flatness to f-rings is explored. Dissert. Abstr.

N78-27831 Oregon State Univ., Corvallis.
GENERALIZED CONVEX BODIES OF REVOLUTION IN n-DIMENSIONAL SPACE Ph.D. Thesis
Keane Bentley Mcgee, Jr. 1978 85 p
Avail: Univ. Microfilms Order No. 7808659

Techniques of combining convex bodies of revolution in n-dimensions are considered: vector, Blaschke, and p-sums intermediate to vector and Blaschke addition. Explicit description of these additions are formulated in terms of functions describing the meridians. Dissert. Abstr.

N78-27832 Cornell Univ., Ithaca, N. Y.
EXPLOITING SPARSITY IN NEWTON-LIKE METHODS Ph.D. Thesis
Earl Stanley Marwil 1978 89 p
Avail: Univ. Microfilms Order No. 78-09496

The basic problem considered is to solve sparse systems of nonlinear equations. Algorithms are presented and their convergence properties are analyzed. Schubert's method for solving sparse nonlinear equations is a well known quasi-Newton method. A symmetric Schubert update is derived using an iterative perfection technique. The update is expressed in a closed form at the expense of an additional sparse linear system to be solved at each iteration in the algorithm. Another method of solving sparse nonlinear equations is presented using a matrix factorization. An approximate Jacobian is factored and one of the triangular factors is updated with Schubert's updated formula. Algorithms are suggested with local and superlinear convergence properties. Another Schubert's method is proposed for problems in which the Jacobian of the nonlinear system can be written as the direct sum of two transformations. An algorithm is sketched and local and superlinear convergence properties are conjectured. Dissert. Abstr.

N78-27833 Brown Univ., Providence, R. I.
HOPE BIFURCATION IN EQUATIONS WITH INFINITE DELAYS Ph.D. Thesis
Paulo Figueiredo Lima 1977 181 p
Avail: Univ. Microfilms Order No. 7809073

Infinite delays were studied in functional differential equations of the class x = f(t sub x, x sub t). The initial value problem associated with this equation is discussed. Taking a space of initial data, a set of axioms is proposed for the influence measure in such a way that the basic existence results can be proved for the differential equation. Linear autonomous equations are studied using semigroup theory. To develop the linear theory for the equation, additional restrictions are imposed on the influence measure, but the class of spaces is still general enough to include fading memory spaces. The existence of periodic solutions bifurcating from equilibrium is proved. An application of the bifurcation result is discussed for equations derived from a model proposed for the study of biological oscillations. Dissert. Abstr.

N78-27834 Texas Univ. at Austin.
STABLE HOMEOMORPHISMS OF THE PSEUDO-ARC Ph.D. Thesis
Ira Wayne Lewis 1977 46 p

Avail: Univ. Microfilms Order No. 7807339

After showing what kinds of conditions a stable homeomorphism of a pseudo-arc must satisfy a sequence of theorems about amalgamating chains is proven. These are then used to construct a wide variety of stable homeomorphisms, as indicated by the following theorem. Let U be an open subset of the pseudo-arc P. Let p and q be distinct pts. of P so that the subcontinuum M irreducible between p and q does not intersect cl(U). Then there exists a homeomorphism h:if P, then P with h(p) = q and h/U = 1U. Related results on other hereditarily indecomposable continua are discussed briefly. Dissert. Abstr.

N78-27835 Houston Univ., Tex.
SIMPLY CONNECTED PARTITIONS OF ONE-DIMENSIONAL AND PLANAR CONTINUOUS CURVES Ph.D. Thesis
Joseph Frederick King, Jr. 1977 77 p
Avail: Univ. Microfilms Order No. 7808106

The existence of decreasing sequences of partitions, whose members are simply connected, is shown for continuous curves in E2 that have a countable basis of simply connected open sets and for one-dimensional continuous curves that have a countable basis of simply connected open sets. It is also shown that if a continuous curve in E2 or a one dimensional continuous curve has a countable basis of simply connected open sets, then it has a countable basis of simple connected open sets whose subintersections are simply connected. Dissert. Abstr.

N78-27836 Texas Univ. at Austin.
DEVELOPMENTS IN HIGH-ORDER RUNGE-KUTTA-NYSTROEM FORMULAS Ph.D. Thesis
Mary Kathleen Horn 1977 297 p
Avail: Univ. Microfilms Order No. 7807321

High order Runge-Kutta-Nystroem formulas were developed to treat the initial value problem for systems of second order ordinary differential equations in which the first derivative is absent from the right hand side of the equation. Coefficients are determined which yield algorithms having minimal truncation error terms and large stability regions. Algorithms having a minimum number of function evalutions are derived for 7th and 8th order methods as well as 7th, 8th, and 9th order algorithms having step size control on both y and y. The new methods are applied to several test problems, and the results are compared with those from existing Runge-Kutta-Nystroem algorithms. Modifications are proposed to improve the efficiency of the algorithms in dealing with the difficulties of rejected steps and of data determination at specified points. Dissert. Abstr.

N78-27837 Tulane Univ., New Orleans, La.
MIXED PROBLEMS FOR THE HAMILTON-JACOBI EQUATION Ph.D. Thesis
Erasmus Eugene Feltus 1977 73 p
Avail: Univ. Microfilms Order No. 7807650

Mixed initial-boundary value problems for the Hamilton-Jacobi equation are studied. Existence and uniqueness are proved in the class of uniformly semiconcave functions. Uniqueness is proved in several dimensions in general cylindrical domains and existence is proved in the two-dimensional quarter plane. Dissert. Abstr.

N78-27838 Adelphi Univ., Garden City, N. Y.
QUARTERNIONS IN PURE AND APPLIED MATHEMATICS Ph.D. Thesis
Alan Chutsky 1978 215 p
Avail: Univ. Microfilms Order No. 7808602

The results of researches into Hamilton's number-couple concept and its extensions to Triple Algebras are presented. Only after a long reflection on these notions was Hamilton led to the discovery of quaternions, which solved the problem of generalizing complex numbers. Three applications of quaternions, namely to spherical trigonometry, to rotations in three and four space and to number theory are also presented. Accordingly, the paper is divided to reflect this dichotomy of purpose. The history and development of Hamilton's number-couples, Triple Algebras, and the final discovery of quaternions and Octonions are reported. Much of the material used in this paper is derived from Hamilton's original Notebooks and Loose Papers.
Dissert. Abstr.

N78-27839 Utah Univ., Salt Lake City.
A RAPIDLY CONVERGENT NUMERICAL TECHNIQUE FOR SOLVING DELTA U PLUS k2U EQUALS 0 IN THE EXTERIOR OF A PLANAR DOMAIN Ph.D. Thesis
Yu-Hsing Chiu 1978 67 p
Avail: Univ. Microfilms Order No. 7808321

Solving the exterior Dirichlet problem Delta U + k squared U = 0, (Im k greater than or equal to 0) with Sommerfeld's radiation condition induces a singular integral equation. The Galerkin method with a basis which depends on the Wittaker's Cardinal Functions was used to obtain a numerical solution to a portion of the integral equation. A setting of integral equations relating to the exterior Dirichlet problem and an introduction of the Galerkin method to solve an operator equation are given. The numerical method for interpolation and integration to handle the singularities are described. The method for solving the integral equations is also described. The error analysis for this numerical method is given. Dissert. Abstr.

N78-27840 New York Univ., N. Y.
BIFURCATION OF PERIODIC ORBITS ON MANIFOLDS, AND HAMILTONIAN SYSTEMS Ph.D. Thesis
Matthew Stephen Bottkol 1977 52 p
Avail: Univ. Microfilms Order No. 7808507

Vector fields on manifolds which possess invariant submanifolds on which the induced flow of the vector field has only periodic orbits are studied. Periodic orbits of the perturbed flow are considered to be 'bifurcating off' the manifold and correspond to orbits of the unperturbed flow along which a certain vector field-invariant vector field on the manifold vanishes. In the Hamiltonian case, the vector field V is found to be intimately connected to the classical 'action' of a closed path, and vanishes at critical points of a certain vector field-in variant function defined on the manifold. Critical point theory is applied to estimate the number of periodic points which bifurcate in the Hamiltonian case, and these results are used in several examples from celestial mechanics. A discrete analog of the construction used for flows is presented and in the Hamiltonian case this serves to relate a type of 'genrating function' to the function S. Dissert. Abstr.

N78-27841 Pennsylvania State Univ., University Park.
INTERPOLATING SEQUENCES AND THEIR APPLICATIONS TO POROUS EXCEPTIONAL SETS Ph.D. Thesis
Samih Amer Obaid 1977 80 p
Avail: Univ. Microfilms Order No. 7808403

The problem of interpolation by functions which are analytic and bounded in the upper-half plane are discussed. Sequences with one limit point are mainely considered. One objective is to find classes of sequences wilder than those found by both Wortman and Weiss. A sequence in these classes is an interpolating sequence if and only if the infimum of the pseudohyperbolic distance of the consecutive terms of the sequence is positive. The other objective is to find a simple Euclidean condition for interpolation which makes it easier to find a class of interpolating sequences different from the typical ones. Certain exceptional sets related to cluster theory are generalized.
Dissert. Abstr.

N78-27842 Nebraska Univ. - Lincoln.
THE NUMBER OF SOLUTIONS TO A SYSTEM OF DIVISIBILITY CONDITIONS Ph.D. Thesis
Robert Alan Meyer 1977 103 p
Avail: Univ. Microfilms Order No. 78-08169

Admissible parameters for Steiner systems are discussed. Solutions to the problem are found for three, four, and five divisibility conditions. The general case of n divisibility conditions is discussed and several conjectures concerning the final solution are made. Dissert. Abstr.

N78-27843*# National Aeronautics and Space Administration, Washington, D. C.
A NUMERICAL METHOD OF DETECTING SINGULARITY
M. LaPorte and J. Vignes Jun. 1978 17 p refs Transl. into ENGLISH from Numerisch Math. (West Germany), v. 23, 1974 p 73-81 Original language document was announced as A75-16100 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-2790)

(NASA-TM-75330) Avail: NTIS HC A02/MF A01 CSCL 12A

A numerical method is reported which determines a value C for the degree of conditioning of a matrix. This value is C = O for a singular matrix and has progressively larger values for matrices which are increasingly well-conditioned. This value is C sub = C max sub max (C defined by the precision of the computer) when the matrix is perfectly well conditioned. G.G.

N78-27844*# National Aeronautics and Space Administration, Washington, D. C.

NUMERICAL INVERSE LAPLACE TRANSFORMATION FOR DETERMINING THE SYSTEM RESPONSE OF LINEAR SYSTEMS IN THE TIME DOMAIN

R. Friedrich and W. Drewelow Jun. 1978 10 p refs Transl. into ENGLISH from Math.-Naturwissenschaftliche Reihe (West Germany), v. 25, no. 8, 1976 p 887-889 Original language document was announced as A77-51267 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(NASA-TM-75304) Avail: NTIS HC A02/MF A01 CSCL 12A

An algorithm is described that is based on the method of breaking the Laplace transform down into partial fractions which are then inverse-transformed separately. The sum of the resulting partial functions is the wanted time function. Any problems caused by equation system forms are largely limited by appropriate normalization using an auxiliary parameter. The practical limits of program application are reached when the degree of the denominator of the Laplace transform is seven to eight. G.G.

N78-27845# Texas A&M Univ., College Station.

AN EXACT SMALL SAMPLE THEORY FOR POST-STRATIFICATION

D. C. Doss (Alabama Univ., Huntsville), H. O. Hartley, and G. R. Somayajulu Mar. 1978 25 p refs

(Grant DAAG29-77-G-0086)

(AD-A053919; TR-1; ARO-14209.1-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

A genuine small sample theory for post-stratification is developed in this paper. This includes the definition of a ratio estimator of the population mean Y, the derivation of its bias and its exact variance and a discussion of variance estimation. The estimator has both a within strata component of variance which is comparable with that obtained in proportional allocation stratified sampling and a between strata component of variance which will tend to zero as the overall sample size becomes large. Certain optimality properties of the estimator are obtained. The generalization of post-stratification from the simple random sampling to post-stratification used in conjunction with stratification and multi-stage designs is discussed. Author (GRA)

N78-27846# Maryland Univ., College Park. Computer Science Center.

CONNECTIVITY IN LATTICES AND MOSAICS Interim Report

Narendra Ahuja Feb. 1978 44 p refs

(Grant AF-AFOSR-3271-77; AF Proj. 2304)

(AD-A053903; TR-637; AFOSR-78-0776TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper is concerned with connectivity in regular lattices and random mosaics, and makes two major contributions. First, it presents a solution to the hitherto unsolved problems of predicting the expected numbers of connected components in square and hexagonal lattices, using a one dimensional growth approach that can also be used for some other lattices. Second, it investigates the relationship between connectivity in regular lattices and random mosaics. Experimental results are presented for both the cases. Author (GRA)

N78-27847# Texas A&M Univ., College Station.

A SIMPLE SYNTHESIS-BASED METHOD OF VARIANCE COMPONENT ESTIMATION

H. O. Hartley, J. N. K. Rao (Carleton Univ., Ottawa), and Lynn LaMotte (Houston Univ., Tex.) Mar. 1978 22 p refs

(Contract DAAG29-77-G-0086)

(AD-A053856; ARO-14209.3-M; TR-3) Avail: NTIS HC A02/MF A01 CSCL 12/1

An evaluation is attempted of the ever growing methodology in the estimation of variance components. Optimality properties are sometimes achieved at considerable computational efforts. Certain methods depend on a subjective ordering of the components, and if the ordering is unfortunate the method may fail to yield estimates for certain components while with a different ordering all components may well be estimable. The work involved in attempting all possible orderings of the variance components is usually prohibitive. The present method achieves optimality properties and is nevertheless computationally simple. In fact it possesses Minque optimality for a particular choice of norm, but also various other optimality properties and necessary and sufficient conditions for estimability associated with Minque simplify considerably. Moreover, we are able to derive sufficient conditions for consistency which also provide estimability conditions of a simpler structure. The consistency of our estimators makes them convenient as starting points for a single ML cycle to obtain asymptotically fully efficient estimates. GRA

N78-27848# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Mathematics and Statistics.

THE DISTRIBUTION OF SUMS OF DEPENDENT LOG-NORMAL VARIABLES

S. Zacks and C. P. Tsokos (South Florida Univ., St. Petersburg) 20 Apr. 1978 32 p refs

(Contract N00014-75-C-0529; Grant AF-AFOSR-2711-74; NR Proj. 042-276)

(AD-A053572; TR-31) Avail: NTIS HC A03/MF A01 CSCL 12/1

The present paper studies the properties of the distribution of sums of dependent log-normal random variables and methods to compute numerically their corresponding c.d.f.'s. The dependence between the log-normal variables is defined in terms of the correlation between the corresponding normal variables. Two methods for numerical computations of the exact cumulative distributions are developed first. One can be described as a numerical convolution and the other is a Gauss-Legendre quadrature. These methods are compared by numerical results in standard and non-standard cases. The moments of the distribution of the sum are given explicitly and also the coefficients of skewness and kurtosis. It is shown that for positive correlations the distribution of the sum is approximately log-normal. For negative values of the correlation the log-normal becomes ineffective. Another approximation is given for these cases, based on the first few terms of an Edgeworth expansion. Finally, methods for computing the moments of the logarithm of the sum are developed. Author (GRA)

N78-27849# Sandia Labs., Albuquerque, N. Mex.

DATA FITTING WITH INSUFFICIENT DATA

K. Haskell 1978 18 p ref Presented at Rio Grande ACM Winter Meeting, Las Cruces, N. Mex., 10 Feb. 1978

(Contract EY-76-C-04-0789)

(SAND-78-0465; Conf-780224-1) Avail: NTIS MF A01

It is desired to fit a curve through a series of data in the least squares sense. A four-step procedure using piecewise polynomials is detailed. In the example given, Hermite cubics are used to parametrize the data. Calculation shows that it is necessary to constrain the curve, and then solve the constrained least-squares problem. A computer code was developed to handle this type of problem. ERA

N78-27850# Sandia Labs., Albuquerque, N. Mex.

COMPARISON BETWEEN TWO ERROR ESTIMATION PROCEDURES

B. Epstein (New Mexico Univ., Albuquerque) and D. L. Hicks 1977 4 p refs Presented at the 1st Workshop on the Inform. Linkage Between Appl. Math. and Ind., Monterey, Calif. Sponsored in part by AFWL

(Contract EY-76-C-04-0789)

(SAND-77-1993; Conf-780214-1) Avail: NTIS HC A02/MF A01

Asymptotic procedures to estimate errors incurred in finite-difference approximations of differential equations by their very nature cannot be relied on to provide safe upper bounds on the errors, unless severe restrictions are imposed. An alternative method, the error-gradient estimation procedure, is presented, in which the discretized solution is extended to a continuum solution which can, under suitable hypothesis, be employed to furnish error estimates. While a complete, rigorous theory for the error-gradient procedure does not seem to be

within reach at this time a number of computations have furnished very satisfactory error estimates. In particular, good results were obtained in some shock calculations, where asymptotic procedures appear to be completely inapplicable. ERA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N78-27851 Union Coll., Schenectady, N.Y.
EXACT TRUNCATED SEQUENTIAL METHODS FOR THE DISCRIMINATION AMONG k GREATER THAN OR EQUAL TO 2 HYPOTHESES CONCERNING THE BINOMIAL PARAMETER p, SELECTION OF THE MOST PROBABLE CATEGORY OF MULTINOMIAL POPULATION, AND COMPLETE RANKING OF k BINOMIAL POPULATIONS Ph.D. Thesis
Ramesh Chandra 1976 269 p
Avail: Univ. Microfilms Order No. 78-07891

The theory and construction of exact truncated sequential methods for the: (1) discrimination among k(k greater than or equal to 2) hypotheses concerning the binomial parameter p; (2) selection of the most probable category of a multinomial population; and (3) complete ranking of k binomial populations are considered. In (1), for k=2 two complete methods are considered. In (2), three procedures are considered. In (3), two formulations, one based on odds-ratio Theta sub ij and the other on difference Delta sub ij are considered. Finally, the problem of obtaining point and interval estimates of the binomial and the multinomial parameter(s) based on the available sample from the above sequential experimentations is considered. The Bayes approach is followed; formulations are derived for point and interval estimates. Illustrations and computer programs are included. Dissert. Abstr.

N78-27852 New York Univ., N. Y.
STATISTICS OF NORMAL MODE AMPLITUDES IN A RANDOM OCEAN Ph.D. Thesis
Lewis Bryant Dozier 1977 120 p
Avail: Univ. Microfilms Order No. 7808518

A statistical theory of acoustic propagation in a random ocean, valid in the limit of low acoustic frequency, is present. A random internal wave model gives sound speed fluctuations delta c(r,z,t) about a deterministic profile c(z). Using normal modes phi sub n (r,t), which are randomly coupled via delta c Invoking a quasistatic approximation, the theory reduces time to a parameter. From any initial distribution of modal powers the evolution of their averages to an equilibrium is predicted by coupled power equations. The theory makes similar predictions for average fluctuations of the modal powers about their means. In the equilibrium limit, the theory gives the full probability distribution of the mode amplitudes. The theory was confirmed by large-scale Monte Carlo computer simulation. Dissert. Abstr.

N78-27853 California Univ., Irvine.
THEORY OF STOCHASTIC OPTIMAL TRACKING Ph.D. Thesis
Vaqar Hussain Syed 1977 108 p
Avail: Univ. Microfilms Order No. 7808228

The present theory of stochastic optimal tracking, in the mean-square sense, only considers stationary systems. The main thrust of this work is to extend the existing theory to include nonstationary systems. Thus nonstationary stochastic processes, time-varying plants and sensors, and arbitrary initial times are admissible in this work. Moreover, due to the nonstationary nature of the systems, state-space techniques are exclusively used. This approach is a clear departure from the frequency domain techniques of the present theory. The systems in the open-loop as well as the closed loop configurations are studied. For each case, the appropriate compensators are designed both in terms of their impulse response functions and in terms of their state-space realizations. The conditions for the stability of the resulting systems are derived. Dissert. Abstr.

N78-27854# Stanford Univ., Calif. Dept. of Statistics.
THE COVARIANCE MATRIX OF NORMAL ORDER STATISTICS
C. S. Davis (McMaster Univ.) and M. A. Stephens (McMaster Univ.) 21 Feb. 1978 11 p refs
(Contract N00014-76-C-0475; Grant DAAG29-77-G-0031)
(AD-A053857; TR 14; ARO-14435.14-M; ONR-TR-254) Avail: NTIS HC A02/MF A01 CSCL 12/11

An approximation is given to calculate V, the covariance matrix for normal order statistics. The approximation gives considerable improvement over previous approximatons, and the computing algorithm is available from the authors. Author (GRA)

N78-27855# Texas A&M Univ., College Station.
THE ESTIMATION OF NON-SAMPLING VARIANCE COMPONENTS IN SAMPLE SURVEYS
H. O. Hartley and J. N. K. Rao Mar. 1978 16 p refs
(Grant DAAG29-77-G-0086)
(AD-A053915; TR-2; ARO-14209.2-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper provides a general methodology applicable to essentially any multistage survey in which the last stage units are drawn with equal probabilities. Specifically, our formulas for the estimated variances of target parameter estimates will include all finite population corrections except those in the last stage which are usually negligible. Recent results in the estimation of components of variance in mixed linear models to achieve these results are able to address the problem of estimability of variance components. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N78-27856 Brown Univ., Providence, R. I.
THEORETICAL AND COMPUTATIONAL CONSIDERATIONS FOR FINITE TIME INTERVAL SYSTEM IDENTIFICATION WITHOUT INITIAL STATE ESTIMATION Ph.D. Thesis
Yuen-Kwok Chin 1977 156 p
Avail: Univ. Microfilms Order No. 78-09042

Necessary and sufficient conditions are derived for identifying the system parameters of linear multivariable systems. Unknown disturbances are modeled by the homogeneous solution of a linear matrix differential (or difference) equation with arbitrary frequencies and initial conditions at the beginning of each observation interval. This method can be extended to certain nonlinear systems, time-varying systems, delay systems and linear systems with output feedback. Optimal choice of input signals and values of the pre-chosen parameters used in this scheme are investigated and numerical techniques are discussed. Application to the parameter estimation of a helicopter in longitudinal flight is included. Application to the adaptive control of a time varying tactical missile system is fully discussed. The feasibility and applicability of this identification technique is demonstrated through computer simulation. Dissert. Abstr.

N78-27857 Cincinnati Univ., Ohio.
ON THE COMPLEX NORMAL MODE ANALYSIS OF LARGE COMPLEX SYSTEMS USING STEP-BY STEP INTERCONNECTION OF SUBSYSTEMS Ph.D. Thesis
Ali Youssefi 1977 166 p
Avail: Univ. Microfilms Order No. 78-03420

Large complex systems are evaluated by modal coordinate analysis for each subsystem as well as by using transfer functions for connection points. In each step of analysis resonances, residues, and modal coordinates for the next connection points of the system are calculated. The modal coordinate analysis is completed for a general non-symmetric system and the concept of left-hand modal coordinates is used. A new form of dynamical matrix for determination of left-hand eigen-vectors is presented. The case where there is some multiplicity of resonances is discussed. Numerical techniques are used for determination of resonances in each step and a new first approximation to each resonance is presented. Dissert. Abstr.

N78-27858*# Georgia Inst. of Tech., Atlanta. School of Electrical Engineering.
LECTURES ON ALGEBRAIC SYSTEM THEORY: LINEAR SYSTEMS OVER RINGS
Edward W. Kamen Jul. 1978 73 p refs
(NASA Order A-43119-B; Grant DAAG29-77-G-0085)
(NASA-CR-3016) Avail: NTIS HC A04/MF A01 CSCL 12A

The presentation centers on four classes of systems that can be treated as linear systems over a ring. These are: (1) discrete-time systems over a ring of scalars such as the integers; (2) continuous-time systems containing time delays; (3) large-scale discrete-time systems; and (4) time-varying discrete-time systems. G.G.

N78-27859# Addis Translations International, Portola Valley, Calif.
TOURNAMENT PROBLEM FOR 3-PERSON GAMES Ph.D. Thesis - Friedrick-Wilhelm Univ., 1936
R. Peltesoh Mar. 1978 24 p Prepared for Sandia Labs., Albuquerque, N. Mex. Sponsored by DoE
(SAND-78-6007) Avail: NTIS HC A02/MF A01

The scheduling of play in tournaments of 3-person games is considered. It is shown mathematically that a 3-person-game tournament with 3n participants can be held in such a way that every combination of three participants plays once and only once on each day of play. ERA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N78-27860 Pennsylvania State Univ., University Park.
SOME ASYMPTOTIC FORMULAS IN GROUP THEORY Ph.D. Thesis
Michael Ellsworth Mays 1977 51 p
Avail: Univ. Microfilms Order No. 7808391

Various measures of the absolute or relative frequency of occurrence of groups with certain properties are studied. Asymptotic formulas concerned with cyclic, Abelian, nilpotent, p-nilpotent, solvable, and simple groups, and groups of square-free order are obtained. In some cases where both integers less than n and groups of order less than n are interesting to count, two different measures are obtained for the frequency of occurrence of that property. Dissert. Abstr.

N78-27861 Texas Univ. at Austin.
STUDIES IN LOCAL UNCONDITIONAL STRUCTURE IN BANACH SPACES AND CHARACTERIZATIONS OF COMPLEX PREDUAL L SUB 1-SPACES Ph.D. Thesis
James Warren Lindsay, II 1977 71 p
Avail: Univ. Microfilms Order No. 7807340

Banach spaces that have the local unconditional structure LUST or the similar structure GL-LUST are considered generalizations of spaces with an unconditional basis. They are also considered to generalize Banach lattices. Some of the relations between LUST and GL-LUST are investigated. The question of whether a space with GL-LUST has LUST is studied and several equivalent formulations are given. In the process, necessary and sufficient conditions for some spaces with GL-LUST to have LUST are developed. New characterizations of comple LUST and GL-LUST are also given. Characterization of complex predual L sub 1-spaces are presented. The results obtained are complex analogues of the characterizations of real predual L sub 1-spaces in terms of barycentric maps. In particular, the complex A sub O(S), A(S), C sub sigma, C sub Sigma, and M spaces are characterized. Dissert. Abstr.

N78-27862 Cornell Univ., Ithaca, N. Y.
RECURSION THEORY ON COUNTABLE ABELIAN GROUPS Ph.D. Thesis
Charlotte Rose Lin 1977 39 p
Avail: Univ. Microfilms Order No. 78-07753

Recursive theory is used to determine the effective content of (countable Abelian group) theory. Each G is presented as a quotient of the free group (gamma sub i)* modulo a sub group R*. G is recursively presented (rp) if R* is a recursive subset of (gamma sub i)*. An isomorphism phi between two rp groups G and H is recursive isomorphism if (x,y) belongs to the set G x H such that the function phi(x) = y is r.e. Classical structure theorems and such notions as height and dependence are investigated. Two theorems are proven for their effectiveness: Ulm's theorem is proven effectively false; Prufer's first theorem is proven effectively true; and Prufer's second theorem and Kulikov's criterion are proven effectively false. Dissert. Abstr.

N78-27863 State Univ. of New York, Stony Brook
SINGULARITIES, BRANCHED COVERINGS, AND CHARACTERISTIC CLASSES Ph.D. Thesis
Michael William Jackson 1978 59 p
Avail: Univ. Microfilms Order No. 78-08265

A certain class of singularities of vector bundle homomorphisms is defined and the relationship between the characteristic classes of the vector bundles involved determined. These vector bundle homomorphisms have the property that near its singularity subsets, (which are assumed to be submanifolds), the behavior of the homomorphism is controlled by the topology of the embedding of the singularities, and is an isomorphism elsewhere. Examples are given that show that many naturally occurring maps between manifolds give rise to these types of homomorphisms, notably: branched coverings, dilatations, and some types of generic maps. The basic results are then applied to these examples to obtain relations between the characteristic numbers of manifolds related in these fashions. Dissert. Abstr.

N78-27864 Texas Univ. at Austin.
GENERALIZATION OF GALERKIN ALTERNATING-DIRECTION METHODS TO NONRECTANGULAR REGIONS USING ISOPARAMETRIC ELEMENTS Ph.D. Thesis
Linda Jo Hanes Hayes 1977 127 p
Avail: Univ. Microfilms Order No. 78-07315

General techniques for mapping regions with curved boundaries using finite element isoparametric maps are presented. Three numerical methods are shown. The first method results from applying a Galerkin procedure in the space variable and using a two level finite difference approximation in the time variable. Asymptotic error estimates are derived and are shown to be optimal in certain cases. The second procedure is based on a three level finite difference approximation in time and is first order correct in time. The final procedure is based on a four level finite difference approximation in time and is second order correct in time. This dissertation extends the application of the Galerkin alternating direction techniques to many practical problems. Dissert. Abstr.

N78-27865 Ohio Univ., Athens.
A STUDY OF TORSION AND COTORSION RADICALS, AND PION-INJECTIVITY Ph.D. Thesis
Vijay Kumar Goel 1977 61 p
Avail: Univ. Microfilms Order No. 78-07518

Various results regarding pi injective modules are obtained. It is proved that a module M is pi injective if and only if M is a (V,R)-submodule of M, where V is the subring generated by all the idempotents in the endomorphism ring of the injective envelope M of M. Also, we have shown if R is a prime ring with zero singular ideal then R is a self pi injective if and only if R is either self-injective or a right Ore-domain. Rings whose cyclic modules are pi injective are also characterized. It is shown that if R is a self-injective ring (or if R is a semiperfect ring) then each cyclic R-module is pi injective if and only if R is the direct sum of a semisimple Artinian ring and a finite number of right valuation rings. Dissert. Abstr.

N78-27866 Tennessee Univ., Knoxville.
SEMISTABLE AND SELF-DECOMPOSABLE PROBABILITY MEASURES ON CERTAIN LOCALLY CONVEX SPACES Ph.D. Thesis
Dong Myung Chung 1977 91 p
Avail: Univ. Microfilms Order No. 7807685

Three subclasses of K-regular infinitely divisible probability (prob.) measures on a real locally convex Hausdorff topological vector space (LCTVS) IE are studied. The first deals with K-regular r-semistable prob. measures ($0 < r < 1$), the second with K-regular 1-semistable prob. measures, and the third with K-regular self-decomposable prob. measures. Dissert. Abstr.

N78-27867 Wisconsin Univ., Madison.
UNIFORM CONVERGENCE SETS AND RANDOM WALKS VIA ULTRASPHERICAL POLYNOMIALS Ph.D. Thesis
Boon-Yian Ng 1977 84 p
Avail: Univ. Microfilms Order No. 7804871

Two problems in harmonic analysis are presented. Uniform convergence (UC) sets in countable groupes and the union problem for such sets are considered. It is shown how UC sets can be constructed from sets that satisfy conditions weaker than dissociativity. A few stronger results are obtained for some UC sets in Z. An example is given to indicate that the answer to the union problem for UC sets in general is negative. Random walks generated via ultraspherical polynomials are studied. The state space is the set of non-negative integers, which were treated by them as the dual of SU(2). In the random walks considered, the transition function is dependent on the product linearization coefficients for ultraspherical polynomials. Such random walks are shown to be transient. Asymptotic properties of the n-th step transition probability and the expected number of visits are derived. Dissert. Abstr.

N78-27868 Brown Univ., Providence, R. I.
SOME NEW MATRIX METHODS APPLIED TO MULTIVARIABLE SYSTEM ANALYSIS AND DESIGN Ph.D. Thesis
Panayotis John Antsaklis 1977 97 p
Avail: Univ. Microfilms Order No. 7809029

A number of results dealing with linear, multivariable, time invariant, and finite dimensional systems are presented. In particular, a certain unimodular matrix U(s) is studied and its importance in the evaluation of a minimal differential operator realization of a given transfer matrix is shown. Linear state variable feedback (lsvf) compensation is studied and the general lsvf matrix F is given as a function of the corresponding eigenvectors. Linear output feedback (lof) compensation is also studied and a method to assign min(n,m+p-1) (or more) arbitrary poles, where n is the order and n,p the number of the independent inputs and outputs of the given minimal system, is presented. Dynamic output feedback compensation is studied from the point of view of an appropriate extended lof compensated system and a lower bound on the order of the required compensator for complete and arbitrary pole placement is established. Dissert. Abstr.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N78-27869*# National Aeronautics and Space Administration, Washington, D. C.
NORMALIZATION OF MAGNETIZATION CHARACTERISTICS
V. P. Glukhov, ed. and R. K. Schmidt, ed. Aug. 1978 251 p refs Transl. into ENGLISH from the book "Normaltzatstya Kharakteristik Mamagnichivaniya" Riga, Znatie Publishers, 1974 p 1-195 Sponsored by NASA Transl. by Amerind Publishing Co. Pvt. Ltd., New Delhi Original doc. prep. by Acad. of Sci., Latvian SSR
(Contract NSF C-630)
(NASA-TT-F-16120) Avail: NTIS HC A12/MF A01 CSCL 14B

Fundamental principles are examined of normalization (generalization) of magnetization characteristics of ferromagnetic media at various parameters of the electromagnetic field. It is shown that a wide range of magnetization characteristics could be described by a single generalized pattern. A physical interpretation of this pattern is offered. Normalization principles are described in terms of examples of generalization of experimental magnetization characteristics obtained for quasistatic as well as fast-variable magnetic fields. D.L.G.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N78-27870*# Lockheed-Georgia Co., Marietta.
NOISE CHARACTERISTICS OF UPPER SURFACE BLOWN CONFIGURATIONS: ANALYTICAL STUDIES Topical Report, May 1975 - Nov. 1976
N. N. Reddy, J. G. Tibbetts, A. P. Pennock, and C. K. W. Tam Jul. 1978 138 p refs
(Contract NAS1-13870)
(NASA-CR-2812; LG77ER0102) Avail: NTIS HC A06/MF A01 CSCL 20A

Noise and flow results of upper surface blown configurations were analyzed. The dominant noise source mechanisms were identified from experimental data. From far-field noise data for various geometric and operational parameters, an empirical noise prediction program was developed and evaluated by comparing predicted results with experimental data from other tests. USB aircraft compatibility studies were conducted using the described noise prediction and a cruise performance data base. A final design aircraft was selected and theory was developed for the noise from the trailing edge wake assuming it as a highly sheared layer. G.G.

N78-27871*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PREDICTION OF AIRCRAFT SIDELINE NOISE ATTENUATION
William E. Zorumski Jun. 1978 52 p refs
(NASA-TM-78717) Avail: NTIS HC A04/MF A01 CSCL 20A

A computational study is made using the recommended ground effect theory by Pao, Wenzel, and Oncley. It is shown that this theory adequately predicts the measured ground attenuation data by Parkin and Scholes, which is the only available large data set. It is also shown, however, that the ground effect theory does not predict the measured lateral attenuations from actual aircraft flyovers. There remain one or more important lateral effects on aircraft noise, such as sideline shielding of sources, which must be incorporated in the prediction methods. Experiments at low elevation angles (0 deg to 10 deg) and low-to-intermediate frequencies are recommended to further validate the ground effect theory. Author

N78-27872# Federal Aviation Administration, Washington, D. C. Office of Environmental Quality.
CALCULATIONS OF MAXIMUM A-WEIGHTED SOUND LEVELS dBA
Jun. 1978 69 p
Avail: NTIS HC A04/MF A01

Data including aircraft flight profile information by aircraft type and mode of operation, and peak noise level as a function of slant range to the aircraft are presented to assist Air Traffic and Flight Standards personnel in complying with the requirements of FAA Order 1050. 1b, Policies and Procedures for Considering Environmental Impacts, paragraph 324b(2)(b). A procedure is described for calculating and documenting in an environmental impact statement or negative declaration the maximum A-weighted sound level (in units of A-weighted decibels or dBA) for single aircraft operations at specified noise-sensitive locations in the vicinity of civil airports. A.R.H.

N78-27873# Tennessee Univ., Knoxville.
ULTRASONIC WAVE REFLECTION AT LIQUID-SOLID INTERFACES Interim Technical Report, Jan. 1975 - Apr. 1978
M. A. Breazeale Feb. 1978 75 p
(Contract N00014-76-C-0177)
(AD-A053842; ITR-15) Avail: NTIS HC A04/MF A01 CSCL 20/1

This technical report comprises ten publications on the reflection of ultrasonic waves at liquid-solid interfaces. Description is given of both experimental and theoretical advances in the understanding and utilization of reflection phenomena. Attention is concentrated primarily on the angles at which leaky surface

waves are excited along the interface. Rayleigh angle phenomena are described, as well as the backward shift resulting from a periodicity super imposed on the interface. Utilization of these phenomena in nondestructive evaluation and in underwater acoustics is mentioned. GRA

N78-27874# Naval Surface Weapons Center, White Oak, Md.
TRANSMISSION AND REFLECTION CHARACTERISTICS OF VISCOELASTIC PLATES
W. Madigosky and R. Fiorito 1 Feb. 1978 86 p refs
(ZR00001; ZR01108)
(AD-A054002; NSWC/WOL/TR-78-4) Avail: NTIS HC A05/MF A01 CSCL 17/1

An acoustic transmission matrix program for computing transmission (S) and reflection (R) coefficients for sound waves of arbitrary frequency, incident at arbitrary angles upon viscoelastic plates bounded by semi-infinite fluids, has been developed. The method, an extension of the formulation of Young for elastic plates, utilizes the elastic and viscoelastic material properties of plates and the program is applied here to the problem of choosing materials for acoustic windows and acoustic lenses. The materials considered are Absonic-A, polyethylene and syntactic foam. Computed results are given in the form of transmission and reflection loss and presented as functions of incidence angle and frequency, and are interpreted in terms of the propagation and material constants and modal and half wave plate resonances. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N78-27875 Brandeis Univ., Waltham, Mass.
A CRITICAL EVALUATION OF HEEIS TO MEASURE COMPTON PROFILES Ph.D. Thesis
Dilek Ahmet Barlas 1977 222 p
Avail: Univ. Microfilms Order No. 78-08624

High precision Compton profile measurements on helium and molecular hydrogen, obtained by high energy electron impact using 35 keV incident electrons as a probe, are presented. Electron Compton profiles were studied for both He and H2 over a momentum transfer range of 1.5 to 12 a.u. Comparison was made with theoretical calculations, earlier electron scattering experiments, and measurements obtained from different techniques. The theoretical limit for S(K) was reached around K = 7 a.u. However, there were deviations from the ideal Compton profile at large q-values, even though excellent agreement with the most recent calculations was found for the peak region. Dissert. Abstr.

N78-27876 Pennsylvania State Univ., University Park.
EMISSION SPECTRUM OF HYDROGEN CHLORIDE Ph.D. Thesis
Christopher Michael Clayton 1977 86 p
Avail: Univ. Microfilms Order No. 7808337

The infrared emission spectrum from the chemiluminescence of a low pressure hydrogen-chloride flame was measured in high resolution using the recently completed 4.5 meter spectrometer with a 40 cm echelle. Vibrational transitions as high as 6 to 5 in the delta v = 1 sequence, and rotational lines as high as R(35), were observed for H-35 Cl and H-37 Cl. The spectrum was recorded, measured, and analyzed through the use of a computer program. A reliable set of ground state constants was determined for both H-35 Cl and H-37 Cl. A consistent set of band constants for the hot bands were determined and a set of Dunham energy coefficients was calculated. Dissert. Abstr.

N78-27877# Brookhaven National Lab., Upton, N. Y.
DEPENDENCE OF ANTI W ON THE CHARGE OF HEAVY IONS
M. N. Varma and J. J. Baum Oct. 1977 6 p refs Presented at IAEA Symp. on Natl. and Intern. Standardization of Radiation Dosimetry, Atlanta, 5 Dec. 1977
(Contract EY-76-C-02-0016)
(BNL-23394; Conf-771209-2; IAEA-SM-222/02) Avail: NTIS HC A02/MF A01

Anti W values (average energy required to form an ion pair) were determined for Cl-35 ions in nitrogen and tissue-equivalent gas. These values were compared to previously reported anti W values for oxygen ions and alpha particles in the same media. This comparison was made at two specific values of energy per atomic mass unit of the incident ions. At an energy of 2.57 MeV/amu, the comparison shows anti W is 12% and 10% higher for oxygen ions in tissue-equivalent and nitrogen gas, respectively to alpha particle anti W. At an energy of 0.77 MeV/amu, a similar comparison shows anti W is 20% higher for Cl-35 ions and 12% higher for O-16 ions in tissue-equivalent gas; and 13% and 10% higher, respectively, in nitrogen gas, relative to alpha particle anti W. These results indicate that anti W values depend not only on the energy per atomic mass unit of heavy ions but also on their charge. ERA

N78-27878# Stanford Linear Accelerator Center, Calif.
LEED PROBE FOR SURFACE SPIN SYSTEMS
E. L. Garwin and R. E. Kirby May 1977 4 p refs Presented at the 7th Intern. Vacuum Congr. and 3d Intern. Conf. on Solid Surfaces, Vienna, 12-16 Sep. 1977
(Contract EY-76-S-03-0376)
(SLAC-PUB-1934; Conf-770908-8) Avail: NTIS HC A02/MF A01

The influence of spin scattering on the measured LEED intensities is enhanced by polarizing the incident electron beam. In the spin-polarized LEED system described here, the electron source was zero-electron-affinity GaAs + Cs-O-Cs, illuminated by circularly polarized light. After passage through a 90 degree electrostatic deflector to convert the photoemitted electrons from longitudinal to transverse polarization, the beam passed a constant magnification lens before striking the sample at energies from 10-200 eV. Diffracted intensities were measured by a minicomputer-controlled Faraday cup. Data reduction, storage, and display occurred via dedicated link between the minicomputer and an IBM 370. A synchronous method for measuring the scattered polarization and preliminary results are discussed. ERA

N78-27879# Berkeley Scientific Translation Service, Calif.
PRODUCTION OF NITROGEN, OXYGEN, NEON, AND ARGON NUCLEI IN THE KRION-2 ELECTRON-BEAM ION SOURCE
E. D. Donets and V. P. Ovsyannikov Oct. 1977 41 p refs Transl. into ENGLISH from report by Joint Inst. for Nuclear Research, Dubna (USSR), 1977 41 p Prepared for California Univ., LBL Sponsored by DoE
(UCRL-Trans-1540; JINR-P7-10438) Avail: NTIS HC A03/MF A01

The KRION-2 electron-beam ion source was designed for bench experiments to investigate the use of dense electron beams (over 100 A/sq cm) for ionization purposes. The production of nitrogen and neon nuclei in this source has been reported previously. An ionization factor of approximately 10 to the 20th power/sq cm for an ionizing electron energy of approximately 5 keV was achieved. A number of experiments aimed at investigating the evolution of the charge state spectrum of nitrogen, oxygen, neon, and argon ions as a function of the ionization factor and electron energy have been carried out. A brief description of the experimental setup and of the recent experiments conducted with the KRION-2 source is presented. A primary analysis of the results of these experiments is made. Author (ERA)

N78-27880# Weizmann Inst. of Science, Rehovoth (Israel).
THREE GENERATIONS OF QUARKS AND LEPTONS
Haim Harari Jul. 1977 15 p refs Presented at 5th Intern. Conf. on Exptl. Meson Spectry., Boston, 29-30 Apr. 1977 Prepared in cooperation with Stanford Linear Accelerator Center, Calif.
(Contract EY-76-S-03-0326)
(SLAC-PUB-1974; Conf-770406-6) Avail: NTIS HC A02/MF A01

The spectroscopy of quarks and leptons is reviewed with emphasis on weak transitions, mass patterns, right-handed currents, Cabbo-like angles and the connection between quarks and leptons. ERA

N78-27881# Pennsylvania State Univ., University Park.
EXCITATION AND IONIZATION OF HIGHLY CHARGED IONS BY ELECTRON IMPACT Progress Report, 15 Dec. 1976 - 15 Dec. 1977
Douglas H. Sampson Dec. 1977 30 p refs
(Contract EY-76-S-02-2897)
(COO-2897-2) Avail: NTIS HC A03/MF A01

The procedure for obtaining ionization results for highly charged complex ions from scaled or reduced ionization cross sections Q/sub R/sup H/(nl,u) for hydrogenic ions with Z = infinity was improved and the results compared with the available experimental data. The method appears accurate to within approximately 20 to 30 percent for Z/N equals or is greater than 2, where N is the number of bound electrons per ion, and the accuracy improves as Z increases. Calculations of the reduced cross section Q/sub R/sup H/(3s,u) for ionization from the 3s sublevel were made, and a recommendation given for estimating Q/sub R/sup H(3p,u). With these results together with the previous results, the approximate cross sections for direct ionization from the 1s, 2s, 2p, 3s and 3p sublevels in any complex ion with Z/N equals or is greater than 2 are readily obtained. Results for the scaled hydrogenic ion excitation collision strengths sq Z omega sub H/ and sq Z omega sub H/sup e/ and R-matric elements ZR/sub H/ were completed for 29 transitions at 6 or more energies. ERA

N78-27882# Stanford Linear Accelerator Center, Calif.
IMPLICATIONS OF EXPERIMENT ON GAUGE THEORIES OF THE WEAK AND ELECTROMAGNETIC INTERACTIONS
R. M. Barnett Jun. 1977 23 p refs Presented at the European Conf. on Particle Phys., Budapest, 4-9 Jul. 1977
(Contract EY-76-S-03-0326)
(SLAC-PUB-1961; Conf-770712-3) Avail: NTIS HC A02/MF A01

The phenomenology of four new models (extensions of SU (2) x U (1) models) for gauge theories of the weak and electromagnetic interactions is discussed. The neutral-current phenomenology, neutrino-proton deep-inelastic, neutrino-proton elastic, neutrino-electron elastic, and atomic parity violation is included. The charged-current neutrino scattering includes the y-dependence, the ratio of anti v to v cross sections, and di- and trilepton production. ERA

N78-27883# Iowa Univ., Iowa City. Dept. of Chemistry.
PHOTON AND POSITIVE ION PRODUCTION FROM COLLISIONS OF SUPERTHERMAL HYDROGEN ATOMS WITH LITHIUM ATOMS AND MOLECULES
J. B. Crooks, K. R. Way, S. C. Yang, C. Y. R. Wu, and W. C. Stwalley 1978 7 p refs
(Contract EY-76-S-02-2326)
(COO-2326-33) Avail: NTIS HC A02/MF A01

The visible spectrum resulting from the collision of superthermal (approximately 5eV) H atoms with a Li/Li2 crossed beam are discussed. These first results in the difficult 1 to 10 eV collision regime were obtained with recently developed high intensity plasma-arc source of H atoms. These superthermal H atoms were collided with an intense supersonic lithium beam (approximately 10 percent Li2; Li3 undetectable) with cold internal degrees of freedom (T/sub vib/ = 195 K, T/sub rot/ = 70 K). Low resolution photon and positive ion production in the collision chamber scattering center and medium resolution were detected as well as photon production in the magnet chamber between the skimmer and the magnet. ERA

N78-27884# California Univ., Livermore. Lawrence Livermore Lab.
EXPERIMENTAL STUDIES OF (n, CHARGED PARTICLE) CROSS SECTIONS, ANGULAR DISTRIBUTIONS AND SPECTRA WITH A MAGNETIC QUADRUPOLE SPECTROMETER
R. C. Haight and S. M. Grimes Dec. 1977 16 p refs Presented at the Specialist Meeting on Newton Data of Struct. Mater. for Fast Reactors, Geel, Belgium, 5-8 Dec. 1977
(Contract W-7405-eng-48)
(UCRL-80235; Conf-771233-2) Avail: NTIS HC A02/MF A01

The charged-particle-producing reactions of 15 MeV neutrons with structural materials were studied with a spectrometer based around a magnetic quadrupole lens. Significant improvements in signal-to-background have permitted the detection of protons with energies as low as 800 keV. In several materials, charged particles emitted with energies well below the Coulomb barrier contribute significantly to the total hydrogen and helium production cross sections. The production mechanism for these low-energy particles is second-chance emission in (n,n'p) and n,n'alpha reactions. At the high-energy end of the proton and alpha-particle spectra and for the entire deuteron spectra, non-statistical reaction mechanisms are indicated. Results for Al, Ti, V, Fe, Ni, Cu, Nb, and stainless steel 316 are compared with data from other experimental methods. ERA

N78-27885# Brookhaven National Lab., Upton, N. Y.
H(-) ION SOURCE DIAGNOSTICS
M. W. Grossman 1977 6 p refs Presented at Symp. on the Production and Neutralization of Negative Hydrogen ions
(Contract EY-76-C-02-0016)
(BNL-23649; Conf-770940-17) Avail: NTIS HC A02/MF A01

Electrostatic probe measurements, H/sub alpha/line broadening, and gas pressure and gas flow measurements are discussed with regard to H(-) ion source. Probe measurements imply the plasma density and electron temperature for certain source conditions. Line broadening experiments indicate an atom temperature of several tenths of an eV. The importance of fine structure splitting in analyzing the line profiles is discussed and the H/sub alpha/ line is studied in detail. The determination of the fast neutral particle energy is discussed. Gas flow measurements indicate near molecular flow for the operating ion source pressure without a discharge. In the presence of a discharge, calculations assert that the gas flow, pressure and density will change during the discharge. Preliminary experiments also indicate a possible decrease in the gas flow during the discharge. ERA

N78-27886# Brookhaven National Lab., Upton, N. Y.
SURFACE TRANSPARENT POTENTIALS: FORWARD ANGLE ELASTIC SCATTERING IN HEAVY-ION COLLISIONS
E. H. Auerbach, A. J. Baltz, M. Golin, and S. H. Kahana 1977 34 p refs Presented at Symp. on Heavy-Ion Elastic Scattering, Rochester, N. Y., 25 Oct. 1977
(Contract EY-76-C-02-0016)
(BNL-23461; Conf-771059-7) Avail: NTIS HC A03/MF A01

Surface transparent optical potentials are classified in a simple-minded fashion according to the nature of their absorptive parts. The specific reactions considered are: (O16, O18) reactions to the ground and 2 sub 1(+) excited states of O18 near 65 MeV on several Ni isotopes and backward angle elastic and inelastic scattering in the O16 + Si system near MeV in the center of mass (E(O16) = 55 MeV, E(Si28) = 96.25 MeV). Various cross sections are plotted. ERA

N78-27887# Stanford Linear Accelerator Center, Calif.
QUARK CONFINEMENT
S. D. Drell Oct. 1977 78 p refs Presented at the SLAC Summer Inst., Stanford, Calif., 11-12 Jul. 1977
(Contract EY-76-S-03-0326)
(SLAC-PUB-2020) Avail: NTIS HC A05/MF A01

The problem of the quarks is considered. Some theoretical efforts to understand the novel behavior of quark constituents in the hadron are described, explained, and analyzed.
Author (ERA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N78-27888# Naval Research Lab., Washington, D. C.
INTENSE PROTON BEAM CURRENT MEASUREMENT VIA PROMPT GAMMA RAYS FROM NUCLEAR REACTIONS Interim Report

Jeffery Golden, Redge A. Mahaffey, John A. Pasour, Frank C. Young, and Christos A. Kapetanakos Mar. 1978 15 p refs (AD-A053849; AD-E000146) Avail: NTIS HC A02/MF A01 CSCL 20/8

The current of an intense, pulsed proton beam is experimentally determined by monitoring prompt gamma rays from nuclear reactions induced in a suitable target. Relevant data is given on the reactions employed including 7Li(p, gamma)8Be, 19F(p, alpha gamma)16O, and 12C(p, gamma)13N so that absolute currents can be determined. This method avoids the complication of target blow-off and the need for attenuating screens when applied to high current density beams. Author (GRA)

N78-27889# Rochester Univ., N. Y.
ISABELLE MACHINE GLOSSARY
T. Ferbel and J. Herrera (Brookhaven National Lab., Upton, N.Y.) 23 Aug. 1977 17 p refs Presented at the Isabelle Workshop, Upton, N.Y., 18 Jul. 1977 Prepared in cooperation with Brookhaven National Lab.
(Contract EY-76-C-02-0016)
(BNL-23538; Conf-770753-17) Avail: NTIS HC A02/MF A01

A brief glossary is presented, first giving those terms pertinent to betatron motion followed by those pertinent to synchrotron motion. More general terms are given toward the end. ERA

N78-27890# Stanford Linear Accelerator Center, Calif.
FAST PULSE BEAM GENERATION SYSTEMS FOR ELECTRON ACCELERATORS
R. F. Koontz Jun. 1977 4 p refs Presented at the 10th Intern. Conf. on High Energy Accelerators, Serpukhov, USSR, 11 Jul. 1977
(Contract EY-76-S-03-0326)
(SLAC-PUB-1948; Conf-770709) Avail: NTIS HC A02/MF A01

Physics experiments making use of time-of-flight for neutral particle momentum analysis need very short, or single bunch electron beam pulses. The SLAC storage ring, SPEAR, requires two, one nanosecond injection pulses per accelerator rf pulse, and the new PEP storage ring will use a single one nanosecond pulse per accelerator rf pulse for filling. In both storage ring cases, the beam pulse generation must be synchronized to the ring operating frequencies. Generation of these pulses is accomplished with a combination of a fast pulsed grided gun and a synchronized transverse beam chopper. The injector system, electron gun design, pulser systems, beam choppers, synchronizers, and fast beam pickups are discussed. ERA

N78-27891# Brookhaven National Lab., Upton, N. Y.
NEUTRALIZATION OF POSITIVE PARTICLE BEAMS BY ELECTRON TRAPPING
R. M. Mobley, A. A. Irani, J. L. Lemaire, and A. W. Maschke 1977 4 p ref Presented at the Symp. on the Production and Neutralization of Negative Hydrogen Ions and Beams, Upton, N. Y., 26 Sep. 1977
(Contract EY-76-C-02-0016)
(BNL-23655; Conf-770940-22) Avail: NTIS HC A02/MF A01

Initial results are presented of a planned series of experimental tests of positive ion beam neutralization, involving transverse space charge studies of a 720 keV 60mA H(+) beam in a drift region of 4.6 meters. Two conclusions drawn from the data are: (1) the change in transmission observed is consistent with complete neutralization in the drift pipe for grounded or negative electrodes, and with complete de-neutralization in the case of greater than +240 V electrodes; and (2) background gas ionization cannot be the main source of electrons. Author (ERA)

N78-27892# Ohio Univ., Athens. John Edwards Tandem Accelerator Lab.
OHIO UNIVERSITY TANDEM VAN DE GRAAFF ACCELERATOR Final Report
R. O. Lane Nov. 1977 26 p refs
(Contracts EY-76-C-02-1717; AT(11-1)-1717)
(COO-1719-9) Avail: NTIS HC A03/MF A01

A summary is given of the work carried out at the John Edwards Tandem Accelerator Laboratory of Ohio University during the period 1970 to 1977 on studies of neutron-nucleus interactions and nuclear structure using neutrons as probes. This work utilizes the main and unique characteristic of the accelerator: high current, high voltage tandem. Certain applied areas were also studied, such as the production of short-lived isotopes for use in medical diagnosis, production of very high neutron intensity to observe possible sputtering effects, and proton induced X-ray emission with a microprobe beam. ERA

N78-27893# Stanford Linear Accelerator Center, Calif.
EXPERIMENTAL BASIS FOR THE NEW QUARK
W. K. H. Panofsky Oct. 1977 53 p Presented at the Centennial Meeting, Mathematical and Phys. Soc., Tokyo, 10 Oct. 1977
(Contract EY-76-S-03-0326)
(SLAC-PUB-2025; Conf-7710105-1) Avail: NTIS HC A04/MF A01

Recent developments in high energy particle spectroscopy are surveyed. The experimental basis of recent findings is reviewed in order to give a calibration of the reliability of the foundations upon which this theoretical understanding was built. Included are the discovery of the psi, evidence for charmonium, the psion family, other charmonium states, and charmed particles. ERA

N78-27894# Lehigh Univ., Bethlehem, Pa.
STUDY OF MULTIPARTICLE JET PRODUCTION USING CALORIMETERS AND OTHER HIGH ENERGY PHYSICS RESEARCH Progress Report, 1 Mar. 1977 - 28 Feb. 1978
A. S. Kanofsky Nov. 1977 6 p refs
(Contract EY-76-S-02-2894)
(COO-2894-07) Avail: NTIS HC A02/MF A01

Experimental research on the properties of particle jets produced in high energy particle interactions, the properties of particle channeling through a Ge crystal at high energies, particle interactions with nuclei, and hypernuclei detection is summarized. Author (ERA)

N78-27895# Stanford Linear Accelerator Center, Calif.
LARGE TRANSVERSE MOMENTUM PHENOMENA
Stanley J. Brodsky Sep. 1977 23 p refs Presented at the 8th Intern. Symp. on Multi-particle Dynamics, Kaysersberg, France, 12 Jun. 1977
(Contract EY-76-S-03-0326)
(SLAC-PUB-2009; Conf-770697-3) Avail: NTIS HC A02/MF A01

Because a finite fraction of the momentum of hadrons is carried by elementary quarks fields, hard collisions involving these constituents are expected to produce particles at a very large transverse momentum. Phenomenological features from recent Fermilab and ISR experiments appear to be consistent with the properties expected from underlying two-body scattering subprocesses. The quantum numbers of the leading particles are strongly correlated with the quantum numbers of the incident hadrons indicating that the valence quarks themselves are transferred to large p/sub t/. Various hadron reactions are discussed covering the structure of exclusive reactions, inclusive reactions, normalization of inclusive cross sections, charge correlations, and jet production at large transverse momentum. ERA

N78-27896# Battelle Pacific Northwest Labs., Richland, Wash.
RESEARCH AND DEVELOPMENT ACTIVITIES WASTE FIXATION PROGRAM Quarterly Progress Report, Oct. - Dec. 1976
J. L. McElroy Nov. 1977 57 p refs
(Contract EY-76-C-06-1830)
(PNL-2264; QRP-17) Avail: NTIS HC A04/MF A01

An engineering-scale in-can melting run was made that confirmed a melting rate of 48 kg/h in a 12-in.-dia canister containing a drop-in fin assembly consisting of 8 fins. The feasibility of accurately monitoring the melt level was demonstrated, using equipment located outside the cell. The interface can be located to within 1 in. Increased emphasis was placed on canister design and development. The program, which will lead to a final selection of a canister design, includes material evaluation, heat transfer analysis, strength analysis, and closure design. Long-term (5 year) thermal effects studies began on a low-zinc waste glass formulation. Initial results indicate that this formulation has greatly

improved devitrification properties. Development of several options for multibarrier waste forms were continued. ERA

N78-27897# International Business Machines Corp., Yorktown Heights, N. Y. Research Div.
PROFILING HYDROGEN IN MATERIALS USING ION BEAMS
J. F. Ziegler, C. P. Wu (RCA Labs., Princeton, N. J.), P. Williams (Illinois Univ., Urbana), C. W. White (ORNL), B. Terreault (Quebec Univ.), B. M. U. Scherzer (Max-Planck-Inst. fuer Plasmaphysik, Garching, West Germany), R. L. Schulte (Grumman Aerospace Corp., Bethpage, N. Y.), E. J. Schneid (Grumman Aerospace Corp., Bethpage, N. Y.), C. W. Magee (RCA Labs., Princeton, N. J.), E. Ligeon (CEA, Grenoble, France) et al 1977 63 p refs Presented at the 3d Intern. Conf. on Ion Beam Anal., Washington, D.C., 27 Jun. - 1 Jul. 1977
(Contract W-7405-eng-26)
(CONF-770642-13) Avail: NTIS HC A04/MF A01

Nine ion beam techniques for the profiling of hydrogen materials were evaluated using similar samples of hydrogen ion-implanted into silicon. When possible the samples were analyzed using two or more techniques to confirm the ion-implanted accuracy. The analysis produced a consensus profile of H in silicon which is useful as a calibration standard. The techniques used have capabilities ranging from very high depth resolution (approximately 50 A) and high sensitivity (less than 1 ppM) to deep probes for hydrogen which can sample throughout thin sheets (up to 0.2 mm thick). ERA

N78-27898# Los Alamos Scientific Lab., N. Mex.
GENERAL-PURPOSE HEAT SOURCE PROJECT, SPACE NUCLEAR SAFETY PROGRAM, AND RADIOISOTOPIC TERRESTRIAL SAFETY PROGRAM Progress Report, Jan. 1978
R. D. Baker, comp. 1978 36 p refs
(Contract W-7405-eng-36)
(LA-7184-PR) Avail: NTIS HC A03/MF A01

Activities related to the use of plutonium-238 oxide in radioisotopic power systems are reported. Topics covered include impact tests of high density fuel pellets, mechanical properties of (Pu238)(O2) pellets, iridium formality studies, and terrestrial environmental chamber studies. ERA

N78-27899# Sandia Labs., Albuquerque, N. Mex.
INTENSE ION BEAM ACCELERATION AND TRANSPORT
S. Humphries, Jr. 1977 21 p refs Presented at Topical Meeting on Inertial Confinement Fusion, San Diego, Calif., 7 Feb. 1978
(Contract EY-76-C-04-0789)
(SAND-77-1552C; Conf-780202-6) Avail: NTIS HC A02/MF A01

Theoretical problems associated with the operation of pulsed linear accelerators for intense ion beams were studied. Numerical models for transverse and longitudinal beam control are discussed, along with methods for suppressing the destructive velocity bunching instabilities resulting from the use of loaded pulselines as voltage sources. Options are considered for the final lens to focus the output beam to fusion targets. ERA

N78-27900# Massachusetts Inst. of Tech., Cambridge.
REVIEW OF HADRON-NUCLEUS INTERACTIONS AT HIGH ENERGY
C. Halliwell 1977 69 p Presented at 8th Intern. Symp. on Multi-particle Dynamics, Kayserberg, France, 12 Jun. 1977
(Contract EY-76-C-02-3069)
(COO-3069-556; Conf-770697) Avail: NTIS HC A04/MF A01

In this review an attempt is made to summarize briefly what is known experimentally and theoretically about hadron-nucleus collisions at high energies. Experimental techniques, multiparticle production, production of high transverse momenta secondaries, and the production of muon pairs are discussed. Author (ERA)

N78-27901# Michigan Univ., Ann Arbor.
THEORETICAL INVESTIGATIONS RELEVANT TO MAGNETIC FUSION ENERGY RESEARCH Progress Report, 1 Jan. 1977 - 1 Jan. 1978
T. Kammash 1978 8 p refs Presented at the Ann. Am. Phys. Soc. Meeting, Atlanta, 7 Nov. 1977
(Contract EY-76-S-01-1478)
(CONF-771136) Avail: NTIS HC A02/MF A01

The following topics are examined: high frequency microinstabilities in field-reversed mirror geometry, particle orbits in field-reversed magnetic geometry, the variational approach to the drift instability, and viscous damping of ion cyclotron waves. ERA

N78-27902# Atlantic Research Corp., Alexandria, Va. Combustion Technology Group.
HYDROGEN SUPPRESSION STUDY AND TESTING OF HALON 1301, PHASE 3 Final Report, Oct. 1976 - Mar. 1978
Edward T. McHale Mar. 1978 98 p
(Contract MA-T-38169)
(PB-278911/3; ARC-47-5702; MA-RD-920-78033) Avail: NTIS HC A05/MF A01 CSCL 21F

The feasibility of employing Halon 1301 in an explosion suppression system for a maritime nuclear reactor is considered. The results of the study support the concept of using Halon 1301 for containment protection. Instrumentation to monitor the chemical composition of a containment vessel atmosphere was evaluated; a study of the radiolytic decomposition of Halon 1301 in water was performed, and a computer code to calculate the Halon requirement of a containment is presented. GRA

N78-27903# Kentucky Legislative Research Commission, Frankfort.
REPORT OF THE SPECIAL ADVISORY COMMITTEE ON NUCLEAR WASTE DISPOSAL
Oct. 1977 24 p
(PB-279271/1; RR-142) Avail: NTIS HC A02/MF A01 CSCL 18G

The Special Advisory Committee on Radioactive Waste Disposal determined that the problems of nuclear waste disposal at the Maxey Flats disposal site could be categorized into three broad areas of concern, namely public health issues, future federal and state policy options, and financial aspects. The committee findings and recommendations are summarized. GRA

74 OPTICS

Includes light phenomena.

N78-27904* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEVICE FOR MEASURING THE CONTOUR OF A SURFACE Patent
Ernest E. Burcher, Stephen J. Katzberg, and William L. Kelly, IV, inventors (to NASA) Issued 9 May 1978 6 p Filed 8 Nov. 1976 Supersedes N77-10497 (15 - 01, p 0069)
(NASA-Case-LAR-11869-1; US-Patent-4,088,408; US-Patent-Appl-SN-740155; US-Patent-Class-356-120; US-Patent-Class-356-167) CSCL 20F

Light from a source is imaged by a lens onto a surface so that the energy from the source is concentrated into a spot. As the spot across the surface is scanned, the surface moves relative to the point of perfect focus. When the surface moves away from perfect focus the spot increases in size, while the total energy in the spot remains virtually constant. The lens then reimages the light reflected by the surface onto two detectors through two different sized apertures. The light energy going to the two detectors is separated by a beam splitter. This second path of the light energy through the lens further defocuses the spot, but as a result of the different sizes of the apertures in each light detector path, the amount of defocus for each is different. The ratio of the outputs of the two detectors which are indicative of the contour of the surface is obtained by a divider. Official Gazette of the U.S. Patent Office

N78-27905*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
THE FAR FIELD DIFFRACTION PATTERN FOR CORNER REFLECTORS WITH COMPLEX REFLECTION COEFFICIENTS

R. F. Chang, D. G. Currie, C. O. Alley, and M. E. Pittman (Louisiana State Univ., New Orleans) Apr. 1970 34 p refs
(Contract NAS9-7809; Grants NGR-21-002-109; NsG-398)
(NASA-CR-157303; TR-70-104) Avail: NTIS HC A03/MF A01 CSCL 20F

The far field diffraction pattern of a geometrically perfect corner reflector is examined analytically for normally incident monochromatic light. The states of polarization and the complex amplitudes of the emerging light are expressed through transformation matrices in terms of those of the original incident light for each sextant of the face in a single coordinate system. The analytic expression of the total diffraction pattern is obtained for a circular face. This expression consists of three component functions in addition to the basic Airy function. The coefficient of each function is expressed in terms of complex coefficients of reflectance of the reflecting surface. Some numerical results for different reflecting surfaces, including total internal reflection, are presented. The iso-intensity contours of the diffraction pattern evaluated from the analytical expressions for an uncoated solid corner reflector are also presented along with the photographs of the pattern. Author

N78-27906*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INVESTIGATION OF LIGHT SCATTERING AS A TECHNIQUE FOR DETECTING DISCRETE SOOT PARTICLES IN A LUMINOUS FLAME
Jul. 1978 21 p refs
(NASA-TP-1235; L-12130) Avail: NTIS HC A02/MF A01 CSCL 20F

The practicability of using a classical light-scattering technique, involving comparison of angular scattering intensity patterns with theoretically determined Mie and Rayleight patterns, to detect discrete soot particles (diameter less than 50 nm) in premixed propane/air and propane/oxygen-helium flames is considered. The experimental apparatus employed in this investigation included a laser light source, a flat-flame burner, specially coated optics, a cooled photomultiplier detector, and a lock-in voltmeter readout. Although large, agglomerated soot particles were detected and sized, it was not possible to detect small, discrete particles. The limiting factor appears to be background scattering by the system's optics. G.G.

N78-27907# ARO, Inc., Arnold Air Force Station, Tenn.
INTERFEROMETRIC PARTICLE SIZING Final Report, Sep. 1976 - Apr. 1977
D. W. Roberts, B. W. Bomar, and R. W. Menzel Apr. 1978 41 p refs
(AD-A053729; AEDC-TR-77-116) Avail: NTIS HC A03/MF A01 CSCL 14/2

The theory and experimental conditions are summarized under which single, spherical particles in the size range of a few micrometers and larger may be accurately sized using the observed fringe visibility in a crossed-beam laser velocimeter. Scalar diffraction theory and experimental data are presented to show how the size information in the forward scattered light is dependent on the collection optics geometry, including the size and shape of source beam stops. The scattered light signal waveform is analyzed in both the time and frequency domains, and electronic instrumentation is outlined for rapid acquisition of size data. Author (GRA)

N78-27908# Naval Research Lab., Washington, D. C. Optical Science Div.
APPLICATION OF ADVANCED OPTICAL SPECTROSCOPIES TO THE STUDY OF ENERGETIC MATERIALS
J. M. Schnur, P. E. Schoen, R. Miller, C. J. Montrose, and J. P. Sheridan Feb. 1978 77 p refs
(NR Proj. 092-552; RR0240202)
(AD-A053832; AD-E000147; NRL-MR-3709) Avail: NTIS HC A05/MF A01 CSCL 20/6

This research program has been investigating the applicability of advanced optical techniques to the study of complex material problems associated with high energy substances. The report consists of a series of papers which reflect the substantial progress accomplished. These include: The possible role of viscoelasticity measured by light scattering techniques in determining the structural integrity of rocket propellants; techniques for observing weak Raman signals in the diamond pressure cell; Raman study of conformational characteristics of chain molecules under high pressure; Observation of pressure induced changes in molecular conformation in the liquid alkanes; A simple stepping motor programmer, and an application of a microcomputer to optical spectroscopy. GRA

N78-27909# Sandia Labs., Albuquerque, N. Mex.
HIGH RESOLUTION TIME RESOLVABLE FLASH X-RADIOGRAPHY SYSTEM
J. Chang, G. W. Kuswa, and C. W. Mendel 1978 5 p ref Presented at Topical Meeting on Inertial Confusion, San Diego, Calif., 7 Feb. 1978
(Contract EY-76-C-04-0789)
(SAND-77-1587C; Conf-780202-14) Avail: NTIS HC A02/MF A01

A 600 kV, approximately less than 100 micron diameter, and 3 ns flash X-ray source was developed and coupled to a duo-microchanneltron X-ray camera to form a flash X-radiography system capable of 3 ns temporal resolution and 100 micron spatial resolution. The flash X-radiography is used to observe target implosion dynamics and instabilities in relativistic electron beam inertial confinement fusion targets. ERA

N78-27910# McElroy (Ralph) Co., Austin, Tex.
EXPERIMENTAL STUDY OF THE OPTICAL ABSORPTION CROSS SECTIONS OF NITROGEN DIOXIDE
Yu. A. Plastinin 1978 12 p refs Transl. into ENGLISH from the book "Fizicheskaia Gazodinamika Ionizirovannykh i Khimicheski Reagiruiushchikh Gazov" Moscow, Energeticheskii Inst., 1968 p 24-28 Prepared for LASL
(Contract W-7405-eng-36)
(LA-TR-78-1) Avail: NTIS HC A02/MF A01

Absorption spectra are discussed which come from a study of the radiation emitted from nitrogen dioxide heated to T equal to or greater than 2000 K. ERA

N78-27911# California Univ., Livermore. Lawrence Livermore Lab.
MINIATURE X-RAY POINT SOURCE FOR ALIGNMENT AND CALIBRATION OF X-RAY OPTICS
R. H. Price, M. J. Boyle, and S. S. Glaros 1 Nov. 1977 25 p refs Presented at the Ann. Am. Phys. Soc. Meeting, Atlanta, 7 Nov. 1977
(Contract W-7405-eng-48)
(UCRL-79777; Conf-771136-29) Avail: NTIS HC A02/MF A01

A miniature X-ray point source of high brightness is described. One version of the X-ray source is used to align the X-ray optics on the Argus and Shiva laser systems. A second version is used to determine the spatial and spectral transmission functions of the X-ray optics. The spatial and spectral characteristics of the X-ray emission from the X-ray point source are described. The physical constraints including size, intensity and thermal limitations, and useful lifetime are discussed. The alignment and calibration techniques for various X-ray optics and detector combinations are described. ERA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N78-27912 Texas Univ. at Austin.
PARAMETRIC DEPENDENCE OF ION CYCLOTRON INSTABILITIES DRIVEN BY NEUTRAL BEAM INJECTION Ph.D. Thesis
Stephen Harold Brecht 1977 113 p
Avail: Univ. Mcrofilms Order No. 78-07269

Using kinetic theory, the stability of the ion cyclotron wave and its harmonics were examined in the fast and slow wave limits by calculating the energy transfer from the ion beam with a transient Coulomb collisional distribution function to the wave and the subsequent damping of the wave by the background species. Critical density ratios and growth rates were obtained

from these calculations and used to determine the susceptability of the wave to destabilization as a function of injection energy, angle of injection, and basic plasma parameters. The growth rates of these waves are a small fraction of the ion cyclotron frequency. These waves are found to be sensitive to the ion temperature of the thermal plasma due to their resonant nature. It is predicted that instabilities near the harmonics of the ion cyclotron frequency should be observed in future Tokamaks injected with neutral beams if the ion thermal temperature is below approximately 4 keV. Dissert. Abstr.

N78-27913* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PLASMA CLEANING DEVICE Patent
Roger L. Shannon (Boeing Co., Seattle) and Roger B. Gillette, inventors (to NASA) (Boeing Co., Seattle) Issued 9 May 1978 6 p Filed 10 May 1976 Supersedes N76-24001 (14 - 14, p 1857) Sponsored by NASA
(NASA-Case-MFS-22906-1; US-Patent-4,088,926; US-Patent-Appl-SN-684807; US-Patent-Class-315-111.2; US-Patent-Class-29-81C; US-Patent-Class-313-231.3) Avail: US Patent Office CSCL 20I

High vacuum cleaning of contaminated surfaces such as hydrocarbon containment films can be accomplished by a plasma cleaning device which includes a plasma discharge housing to permit generation of a plasma in an environment having a higher pressure than the surface which is to be cleaned. A ground electrode and a radio frequency electrode partially surround a quartz plasma tube, for the introduction of an ionizable gas. These electrodes ionize the gas and help generate the plasma. This plasma flows through a non-constrictive aperture, through the plasma discharge housing and then on to the contaminated surface. Official Gazette of the U.S. Patent Office

N78-27914*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MICROWAVE RADIATION MEASUREMENTS NEAR THE ELECTRON PLASMA FREQUENCY OF THE NASA LEWIS BUMPY TORUS PLASMA
R. Mallavarpu and J. R. Roth 1978 21 p refs Presented at the meeting of the Plasma Phys. Div. of the Am. Phys. Soc., Colorado Springs, Colo., 30 Oct. - 3 Nov. 1978
(NASA-TM-78940; E-9686) Avail: NTIS HC A02/MF A01 CSCL 20I

Microwave emission near the electron plasma frequency was observed, and its relation to the average electron density and the dc toroidal magnetic field was examined. The emission was detected using a spectrum analyzer and a 50 omega miniature coaxial probe. The radiation appeared as a broad amplitude peak that shifted in frequency as the plasma parameters were varied. The observed radiation scanned an average plasma density ranging from 10 million/cu cm to 8 hundred million/cu cm. A linear relation was observed betweeen the density calculated from the emission frequency and the average plasma density measured with a microwave interferometer. With the aid of a relative density profile measurement of the plasma, it was determined that the emissions occurred from the outer periphery of the plasma. A.R.H.

N78-27915# Nagoya Univ. (Japan). Inst. of Plasma Physics.
A NEW TREATMENT OF LOCALIZED MODES IN INHOMOGENEOUS VLASOV PLASMA
Tsuguhiro Watanabe Apr. 1978 15 p refs
(IPPJ-330) Avail: NTIS HC A02/MF A01

An eigenmode analysis is established in plasma with arbitrary density profile. Finite Larmor effect is taken into account even if K sub x rho is greater than 1. Eigenfrequencies are determined through a compact quantization condition. Author

N78-27916# Nagoya Univ. (Japan). Inst. of Plasma Physics.
RADIO-FREQUENCY PLUGGING OF A HIGH DENSITY PLASMA
T. Watari, T. Hatori, R. Kumazawa, S. Hidekuma, T. Aoki, T. Kawamoto, M. Inutake, S. Hiroe, A. Nishizawa, K. Adati et al Apr. 1978 27 p refs
(IPPJ-331) Avail: NTIS HC A03/MF A01

Mirror end loss can be suppressed by applying an RF field at the mirror throat through low impedance coils. This method is verified to be effective for a high density plasma up to 10 to the 14th power/cu cm. Experimental results show that the RF field strength required for the plugging is differently dependent on the plasma density according to the type of coil. The mechanism of giving the density dependence is theoretically clarified for each coil. The electric field induced in the direction of the static magnetic field is shown to be intrinsic for the density independent result of type 3 coil. A.R.H.

N78-27917# Nagoya Univ. (Japan). Inst. of Plasma Physics.
PLASMA FLOW DRIVEN BY FUSION-GENERATED ALPHA PARTICLES
Kazunari Ikuta May 1978 11 p refs
(IPPJ-332) Avail: NTIS HC A02/MF A01

The confinement of fusion-generated alpha particles will affect the transports of the background plasma particles by the momentum transfer from the energetic alphas. The ions tend to migrate towards the center of plasma (i.e. fuel injection) and electrons towards the plasma periphery. This indicates the existence of a mechanism which pumps out the ashes in the fuel plasma because of the momentum conservation of whole plasma particles. A.R.H.

N78-27918# Naval Research Lab., Washington, D. C. Plasma Physics Div.
LINEAR STABILITY OF SELF-SIMILAR FLOW. 1: ISOTHERMAL CYLINDRICAL IMPLOSION AND EXPANSION Interim Report
D. L. Book and Ira B. Bernstein Mar. 1978 49 p refs
(Contract E(49-20)-1006; RR0330242)
(AD-A053825; AD-E000149; NRL-MR-3745) Avail: NTIS HC A03/MF A01 CSCL 20/9

A soluble model of the development of the Rayleigh-Taylor instability in perturbations about a time-varying state of a compressible medium is presented. A Lagrangian description is employed to rederive the equations for the self-similar motion of an ideal fluid and to obtain the linearized equations of motion for perturbations about a general time-varying basic state. The resulting formalism is applied in cylindrical geometry to calculate the growth of flute-like Rayleigh-Taylor modes associated with a similarity solution modeling the implosion and expansion of a liquid liner. A complete solution is obtained for the perturbed motion. The only modes for which the perturbation amplitudes grow faster than the unperturbed linear radius are divergence- and curl-free. Numerical and analytical results are obtained for these and shown to reduce in the short wavelength limit to those previously for incompressible time-independent basic states. Author (GRA)

N78-27919# Naval Research Lab., Washington, D. C.
WHYRAC, A NEW MODULAR ONE-DIMENSIONAL EXPLODING WIRE CODE Interim Report
Denis G. Colombant, Martin Lampe, and H. W. Bloomberg Feb 1978 35 p refs
(AD-A053847; AD-E000145) Avail: NTIS HC A03/MF A01 CSCL 20/9

A new one-dimensional code, WHYRAC, intended to provide a comprehensive treatment of exploding wires and wire arrays, is described. The circuit equations treat the wire plasma in an exact way, rather than using a lumped circuit model. Great care has been taken in the Eulerian MHD treatment of plasma motion, resulting in an unusual combination of rapid running capability to handle density ranges spanning at least four orders of magnitude, and very accurate energy conservation in the overall circuit. The code is written in a modular and flexible way, to permit continual upgrading, and extension to different elements of the atomic physics and radiation transport packages. At present, a fairly simple, rapid-running model (one line per ionization level, localized treatment of radiation transport) is used to provide transport at each time step. A much more extensive, state-of-the-art, atomic/radiation code is used to generate output radiation spectra when required, and to benchmark the energy transport package. The report gives special attention to the treatment of numerical problems in WHYRAC. Author (GRA)

N78-27920# Naval Research Lab., Washington, D. C.
A THEORY OF PARTICLE AND ENERGY FLUX FROM THE MAGNETIC FLUTTER OF DRIFT WAVES

W. M. Manheimer and I. Cook Mar. 1978 12 p refs
(AD-A053947; NRL-MR-3752) Avail: NTIS HC A02/MF A01 CSCL 20/9

A quasi-linear theory of particle and energy flux by magnetic flutter associated with drift waves is presented. It is shown that magnetic flutter can enhance the energy flux. However, particle diffusion is ambipolar and runaway electrons do not escape along the field lines. Author (GRA)

N78-27921# Naval Research Lab., Washington, D. C.
ONE DIMENSIONAL dc RESISTIVITY DUE TO STRONG LOW FREQUENCY TURBULENCE Interim Report
H. L. Rowland, P. J. Palmadesso, and K. Papadopoulos Feb. 1978 15 p
(AD-A053949; NRL-MR-3547) Avail: NTIS HC A02/MF A01 CSCL 20/9

A theoretical model is presented showing the effects of finite amplitude ion cavities on the d.c. conductivity of a collisionless one-dimensional plasma. A 20% ion cavity is shown to prevent the acceleration of 50% of the plasma electrons. The effect is independent of cavity width and spacing so that in the case of localized, spiky turbulence, rms ion density fluctuations of a few percent can significantly modify the d.c. response. The theoretical predictions are compared with both particle and Vlasov computer simulations. Author (GRA)

N78-27922# Texas Univ. at Austin. Center for Electromechanics.
HOMOPOLAR GENERATOR DEVELOPMENT AT THE UNIVERSITY OF TEXAS
W. F. Weldon, H. G. Rylander, and H. H. Woodson 1977 9 p refs Presented at Seminar on Energy Storage, Compression and Switching, Canberra, Australia, 15 Nov. 1977
(Contract EG-77-S-05-5594)
(ORO-5594-7; Conf-771132-3) Avail: NTIS HC A02/MF A01

Homopolar generator development since 1972 is reviewed. The first homopolar generator stored 0.65 MJ was capable of self motoring to 6000 r/min in about 12 min with an armature current of 1.0 KA and could discharge in about 3.0s at a current of 14.0 kA. A high brush tester to evaluate mechanical and electrical properties of the various grades of solid brushes available is mentioned. The second homopolar generator stores 5.0 MJ of energy inertially at 5600 r/min and is basically a scaled-up version of the first generator with improved bearings and brush mechanism. Work on fast discharge and industrial problems is discussed. ERA

N78-27923# Texas Univ. at Austin. Center for Electromechanics.
FDX: A FAST DISCHARGE HOMOPOLAR GENERATOR
W. F. Weldon, H. G. Rylander, and H. H Woodson 1977 12 p refs Presented at Seminar on Energy Storage, Compression and Switching, Canberra, Australia, 15 Nov. 1977
(Contract EG-77-S-05-5594)
(ORO-5594-8; Conf-771132-4) Avail: NTIS HC A02/MF A01

The fundamental limitations to the discharge times of homopolar generators were studied and a fast discharge experiment (FDX) was proposed and a small (365 kJ), counterrotating disk type homopolar generator was designed to explore the limits to homopolar generator discharge times. The FDX rotors are forged aluminum alloy with flame sprayed copper slip rings. Solid copper graphite brushes are used with a 95 percent packing factor on the slip rings. The high magnetic field required for fast discharge (3.6 T average) is provided by discharging the CEM 5.0 MJ homopolar generator into a four-turn, graphite-reinforced, room temperature copper coil. The rotors are brought up to speed with two 37 kW air turbines. It is predicted that the machine will ring on its own internal impedance for approximately five cycles in this mode. The discharge coax is shorted by four very fast making switches. Additional impedance can be introduced into the discharge circuit by extending the switch coaxes to allow full speed 1.4 MA discharges in approximately 3.5 ms. ERA

N78-27924# Texas Univ. at Austin. Center for Electromechanics.
TEST DATA ON ELECTRICAL CONTACTS AT HIGH SURFACE VELOCITIES AND HIGH CURRENT DENSITIES FOR HOMOPOLAR GENERATORS
M. Brennan, K. M. Tolk, W. F. Weldon, H. G. Rylander, and H. H. Woodson 1977 5 p refs Presented at the 7th Symp. on Fusion Res. Proj., Knoxville, Tenn., 25 Oct. 1977
(Contract EG-77-S-05-5594)
(CONF-771029-121) Avail: NTIS HC A02/MF A01

One grade of copper graphite brush material, Morganite CMIS was tested, over a wide range of surface velocities, atmospheres, and current densities that are expected for fast discharge (less than or equal to 100 ms) homopolar generators. The brushes were run on a copper coated 7075-T6 aluminum disk at surface speeds up to 277 m/sec. One electroplated copper and three flame sprayed copper coatings were used during the tests. Significant differences in contact voltage drops and surface mechanical properties of the copper coatings were observed. ERA

N78-27925# Texas Univ., Austin. Center for Electromechanics.
SYSTEM ENGINEERING AND DESIGN OF A PULSED HOMOPOLAR GENERATOR POWER SUPPLY FOR THE TEXAS EXPERIMENTAL TOKAMAK
W. L. Bird, G. B. Grant, W. F. Weldon, H. G. Rylander, and H. H. Woodson 1977 5 p refs Presented at 7th Symp. on Fusion Res. Proj., Knoxville, Tenn., 25 Oct. 1977
(Contract EG-77-S-05-5594)
(CONF-771029-114) Avail: NTIS HC A02/MF A01

The design of a homopolar generator power supply for the Texas Experimental Tokamak (TEXT) is presented. Four series-connected disk type homopolar machines serve as inertial energy storage and conversion devices to supply 50 to 7 MW peak power to the toroidal field coil and ohmic heating coil circuits. The system is nominally operated at 150 MJ, 430 V to provide a 0.5 sec flat top, every 2.0 min on a continuous basis. The system has a maximum capacity of 200 MJ at a maximum open circuit voltage of 500 V. The homopolar machine design is described. ERA

N78-27926# Texas Univ., Austin. Center for Electromechanics.
ELECTROMAGNETIC TORQUES AND FORCES DUE TO MISALIGNMENT EFFECTS AND EDDY CURRENTS IN THE HOMOPOLAR GENERATOR, POWER SUPPLY FOR THE TEXAS EXPERIMENTAL TOKAMAK (TEXT)
M. D. Driga, W. L. Bird, K. M. Tolk, W. F. Weldon, H. G. Rylander, and H. H. Woodson 1977 5 p refs Presented at the 7th Symp. on Fusion Res. Project, Knoxville, Tenn., 25 Oct. 1977
(Contract EG-77-S-05-5594)
(CONF-771029-118) Avail: NTIS HC A02/MF A01

Asymmetries in the applied magnetic field due to manufacturing tolerances and rotor-stator misalignments can cause significant forces and moments in a homopolar generator. Parasitic eddy-currents in the rotor, brushes and bearings are also important effects of such asymmetries. The finite element method is used to calculate the magnetic flux distribution in the TEXT homopolar generators. The axial magnetic thrust force and the magnetic tilt moment acting on the rotor are calculated. Eddy-current torques opposing rotor motion are determined using the theory for eddy-current brakes. The results have been used in the design of the TEXT homopolar generator which have been proposed to provide the energy store and conversion for the toroidal field and ohmic heating coils of the new Texas Experimental Tokamak. ERA

N78-27927# Texas Univ., Austin. Center for Electromechanics.
CIRCUIT AND MAGNETIC ANALYSIS FOR A SYSTEM OF FARADAY ROTATOR COILS DRIVEN BY A TWO-SPOOL, FOUR-ROTOR HOMOPOLAR GENERATOR
D. J. Mayhall, K. M. Tolk, W. F. Weldon, H. G. Rylander, and H. H. Woodson 1977 4 p refs Presented at the 7th Symp. on the Fusion Res. Project, Knoxville, Tenn., 25 Oct. 1977
(Contract EG-77-S-05-5594)
(CONF-771029-119) Avail: NTIS HC A02/MF A01

As part of a cost optimization study, a computer based circuit analysis is performed to determine the energy storage requirements a homopolar generator must meet to drive an inductive load of Faraday rotator coils, which is an option

considered for a Shiva laser system upgrade. The reference load consists of five parallel sets of three different size solenoidal coils in series. Each coil is modelled as a series inductance and resistance. The homopolar is modelled as a capacitance in series with a resistance and an inductance. The transmission line connecting the homopolar and the coils are modelled as series inductances and resistances. The initial homopolar voltages and energies to create the required coil magnetic fields are obtained versus the small coil turns, homopolar capacitance, and line length, as are the times to current maximum, peak homopolar currents, and peak coil currents. ERA

N78-27928# General Atomic Co., San Diego, Calif.
GAQ: A COMPUTER PROGRAM TO FIND AND ANALYZE AXISYMMETRIC AND PLASMA EQUILIBRIA
F. W. McClain and B. B. Brown Aug. 1977 113 p refs
(Contract EY-76-C-0167-038)
(GA-A-14490) Avail: NTIS HC A07/MF A01

GAQ is a computer code that finds and analyzes free-boundary MHD equilibria of axisymmetric plasmas. The central problem approached by GAQ is that of determining the internal magnetic flux distribution of a toroidal MHD plasma at equilibrium, given the magnetic flux on or near some external conductors and the internal plasma current profile. It is assumed that the plasma currents and all external currents are toroidal and concentric. It is further assumed that the system is axisymmetric thereby reducing the problem to the analysis of a two-dimensional cross section of the torus. ERA

N78-27929# Ebasco Services, Inc., New York.
AC DISTRIBUTION SYSTEM FOR TFTR PULSED LOADS
R. F. Carroll, S. Ramakrishnan, G. N. Lemmon, and W. I. Moo 1977 7 p refs Presented at the 7th Symp. on Fusion Res. Project, Knoxville, Tenn., 25 Oct. 1977
(Contract EY-76-C-02-3073)
(CONF-771029-157) Avail: NTIS HC A02/MF A01

The significant area related to design, protection, and equipment selection, are discussed, particularly where there is a departure from normal utility and industrial applications. ERA

N78-27930# Grumman Aerospace Corp., Bethpage, N.Y.
TFTR TRITIUM VALVE FOR PULSED GAS FEED, TEST RESULTS
J. W. Rockensies, B. Sue, and R. Walls (Princeton Univ.) 1977 3 p Presented at the 7th Symp. on the Fusion Res. Project, Knoxville, Tenn., 25 Oct. 1977
(Contract EY-76-C-02-3073)
(CONF-771029-155) Avail: NTIS HC A02/MF A01

An engineering-model valve to be used for controlling pulsed-feed tritium injection scenarios into the TFTR torus was evaluated in a test program designed to characterize the performance of the valve and determine throughput modulation and repeatability. Testing is being performed primarily with helium gas, but the capability to test with argon, deuterium, and hydrogen gases is available in order to provide an adequate data base to extrapolate to the tritium case. The TFTR, proposed tritium feed system line configurations were also simulated to evaluate dynamic effects of the pulsed feed. ERA

N78-27931# California Univ., Berkeley. Lawrence Berkeley Lab.
ACOUSTIC ABSORPTION BY THE ELECTRON-HOLE LIQUID IN GERMANIUM
A. D. A. Hansen Nov. 1977 227 p refs
(Contract W-7405-eng-48)
(LBL-7326) Avail: NTIS HC A11/MF A01

The absorption of ultrasonic acoustic waves by the electron-hole liquid that may be created in germanium at liquid helium temperatures by intense optical excitation is studied. This degenerate Compensated Fermi liquid exhibits the behavior of both classical dynamics in a force field, and quantum phenomena in a magnetic field. Results of theoretical and experimental studies of the interaction of the mobile liquid with a traveling acoustic wave force field, the attenuation of the wave due to energy-dissipative processes coupling the liquid to the crystal lattice, and the effect of a moderately strong magnetic field on the dynamic behavior of the system are presented. In unstrained germanium the electron-hole liquid is known to be condensed into small droplets of radius approximately 5 micron; the creation of an EHL energy well by the application of an inhomogeneous stress caused the liquid to be aggregated into a macroscopically large volume. ERA

N78-27932# California Univ., Livermore. Lawrence Livermore Lab.
MIRROR HYBRID REACTOR STUDIES
D. J. Bender 19 Jan. 1978 20 p Presented at 2d DMFE Hybrid Reactor Meeting, Wash., D. C., 2 Nov. 1977
(Contract W-7405-eng-48)
(UCRL-80694; Conf-771155-1) Avail: NTIS HC A02/MF A01

The optimization of the point design and work on a reference design for a hybrid reactor are described. The status of the nuclear, and the mechanical design of the machine are reviewed. ERA

N78-27933# California Univ., Livermore. Lawrence Livermore Lab.
FIELD-REVERSAL EXPERIMENTS IN THE MIRROR FUSION TEST FACILITY (MFTF)
J. W. Shearer and W. C. Condit 7 Dec. 1977 17 p refs
(Contract W-7405-eng-48)
(UCRL-52373) Avail: NTIS HC A02/MF A01

Detailed consideration of several aspects of a field-reversal experiment was begun in the Mirror Fusion Test Facility (MFTF). Model calculations have provided some plausible parameters for a field-reversed deuterium plasma in the MFTF, and a buildup calculation indicates that the MFTF neutral-beam system is marginally sufficient to achieve field reversal by neutral injection alone. However, the many uncertainties indicate the need for further research and development on alternate buildup methods. A discussion of experimental objectives is presented and important diagnostics are listed. The range of parameter space accessible with the MFTF magnet design is explored, and we find that with proper aiming of the neutral beams, meaningful experiments can be performed to advance toward these objectives. Finally, it is pointed out that if we achieve enchaned n tau confinement by means of field reversal, then quasi-steady-state operation of MFTF is conceivable. ERA

N78-27934# Los Alamos Scientific Lab., N. Mex.
FUSION APPLICATIONS OF FAST DISCHARGING HOMOPOLAR MACHINES
K. I. Thomassen Jan. 1978 43 p refs Sponsored in part by Electric Power Research Inst.
(Contract W-7405-eng-36)
(EPRI-ER-625) Avail: NTIS HC A03/MF A01

The use of fast discharging homopolar machines, with 1 to 5000 ms delivery times, is discussed for toroidal and linear theta pinches, toroidal z-pinches, liners, and Tokamaks. Typical circuits and machine designs are described. ERA

N78-27935# Mathematical Sciences Northwest, Inc., Bellevue, Wash.
INVESTIGATION OF IMPURITY RADIATION FROM A WELL DIAGNOSED, LASER HEATED PLASMA SAMPLE Final Report
E. Crawford, D. Quimby, A. Hoffman, and Z. A. Pietrzyk 1 Nov. 1977 55 p refs
(Contract W-7405-eng-48)
(UCRL-13794; MSNW-77-1081-1) Avail: NTIS HC A04/MF A01

A deuterium sample plasma is produced and heated to a temperature of 2 to 7 eV at an electron density of 5 x 10 to the 16th power/cu cm. The plasma parameters were monitored at various discrete times during the plasma decay using the Thomson scattering system. Simultaneously, the same sample volume was observed in the visible region of the spectrum using a streak camera coupled to a spectrograph. A continuous record of the plasma visible spectrum was obtained during the plasma time history, with at one specific time a data point on the plasma parameters, n/sub e/ and T/sub e/. Modifications were made to the plasma sample facility to shorten the duration of the preionization current and to increase its magnitude. The electron density in the heated plasma to 5 x 10 to the 16th power essentially obtained full filling density. Additional insulation

was added to the solenoid and satisfactory simultaneous operation of the solenoid at a 20 kV charging voltage and the preionization discharge at a 40 kV charging voltage was demonstrated. ERA

N78-27936# New York Univ., N. Y. Courant Inst. of Mathematical Sciences.
MHD STABILITY FOR A CLASS OF TOKAMAK EQUILIBRIA WITH FIXED BOUNDARY
W. Kerner Aug. 1977 32 p refs
(Contract EY-76-C-02-3077)
(COO-3077-146) Avail: NTIS HC A03/MF A01

The stability behavior with respect to internal modes is discussed for a class of Tokamak equilibria with non-circular cross-sections and essentially flat current profiles. The stability analysis is performed numerically with the help of a normal mode code, which extremizes the Lagrangian of the system. The Mercier criterion is found to be both necessary and sufficient for stability. Strong numerical evidence for this result is given. MHD-stable high-beta equilibria exist in this model. ERA

N78-27937# New York Univ., N. Y. Courant Inst. of Mathematical Sciences.
SUPPLEMENTARY HEATING OF FUSION PLASMAS BY MEANS OF ALFVEN WAVES
J. A. Tataronis and W. Grossmann Sep. 1977 104 p refs
(Contract EY-76-C-02-3077)
(COO-3077-102) Avail: NTIS HC A06/MF A01

The theory of rf energy absorption in inhomogeneous plasmas by means of Alfven waves is presented. A straight cylindrical plasma column whose motion is governed by linearized ideal magnetohydrodynamics (MHD) is assumed to be surrounded by a vacuum region in which an ideal coil consisting of surface currents is placed. The coil is oscillated at frequencies which lie in the MHD continous spectrum of local Alfven frequencies of the inhomogeneous plasma leading to the occurrence of local Alfven resonances. A rigorous self-consistent analysis of the resulting resonant energy absorption is presented along with calculations relevant to present and future fusion devices. Specifically, the experimentally useful coil impedance is calculated for a plasma-vacuum-coil-wall system with realistic nonuniform plasma profiles corresponding to present day Tokamak and Scyllac devices. ERA

N78-27938# Science Applications, Inc., Boulder, Colo. Lab. for Applied Plasma Studies.
TEMPERATURE GRADIENT AND ELECTRON GYRORADIUS EFFECTS ON LOWER HYBRID DRIFT - DRIFT CYCLOTRON INSTABILITIES
J. B. McBride and S. Hamasaki Dec. 1977 22 p refs
(Contract EY-76-C-03-1018)
(LAPS-33; SAI-77-983-LJ) Avail: NTIS HC A02/MF A01

Electron and ion temperature gradients as well as finite electron gyroradius (k rho/sub e/ approximately greater than 1) were retained to analyze the stability of drift waves from the lower hybrid down to the cyclotron frequency. The instability conditions indicate the importance of these modes over this entire frequency range in a variety of applications. ERA

N78-27939# Princeton Univ., N. J. Plasma Physics Lab.
MODEL FOR MAGNETIC RECONNECTION
E. A. Adler and R. M. Kulsrud Mar. 1978 30 p refs
(Contract EY-76-C-02-3073)
(PPPL-1425) Avail: NTIS HC A03/MF A01

A forced reconnection problem was modeled by two infinite wires that are embedded in a plasma and which carry parallel currents. They are brought together at a specified rate. The distance between the wires is taken as 2a(1-e/sup omega/). For small displacements, the hydromagnetic equations can be linearized and solved asymptotically. For larger displacements, the plasma behavior can be estimated by use of scaling arguments. A local velocity of magnetic reconnection is determined and shown to be essentially equal to the maximum possible reconnection velocity (that of the corresponding vacuum case) up to the time when this velocity approaches the local Alfven speed. The solution is compared with the Sweet-Parker and Petschek reconnection theories. ERA

N78-27940# Princeton Univ., N. J. Plasma Physics Lab.
MAGNETIC SURFACES IN THE REVERSED FIELD GEOMETRY
A. H. Boozer Jan. 1978 12 p refs
(Contract EY-76-C-02-3073)
(PPPL-1415) Avail: NTIS HC A02/MF A01

The achievement of field reversal is shown not to ensure a closed magnetic geometry. The closure of the reversed field geometry is found to be critically dependent on the shape of the toroidal component of the magnetic field no matter how small it may be. ERA

N78-27941# Princeton Univ., N. J. Plasma Physics Lab.
EFFECT OF MAGNETIC SHEAR ON DISSIPATIVE DRIFT INSTABILITIES
P. N. Guzdar, L. Chen, P. K. Kaw, and C. Oberman Mar. 1978 13 p refs
(Contract EY-76-C-02-3073)
(PPPL-1426) Avail: NTIS HC A02/MF A01

A linear radial eigenmode analysis of dissipative drift waves in a plasma with magnetic shear and spatially varying density gradient was conducted. The results of the analysis are shown to be consistent with a recent experiment on the study of dissipative drift instabilities in a toroidal stellarator. ERA

N78-27942# Princeton Univ., N. J. Plasma Physics Lab.
STABILITY LIMIT ON BETA IN A TOKAMAK USING THE COLLISIONLESS ENERGY PRINCIPLE
P. H. Rutherford, L. Chen, and M. N. Rosenbluth Feb. 1978 17 p refs
(Contract EY-76-C-02-3073)
(PPPL-1418) Avail: NTIS HC A02/MF A01

It is shown that use of the collisionless, rather than MHD, energy principle has little effect on the limiting beta for stability of a Tokamak against ballooning modes. ERA

N78-27943# Princeton Univ., N. J.
RESONANT DECAY OF FINITE EXTENT COLD ELECTRON PLASMA WAVES Plasma Physics Lab.
K. L. Wong, P. Bellan, and M. Porkolab Feb. 1978 16 p refs
(Contract EY-76-C-02-3073)
(PPPL-1402) Avail: NTIS HC A02/MF A01

The parametric decay of a finite extent cold electron plasma wave (slow wave) was studied experimentally. Using a frequency of omega sub 0 approximately greater than 10 omega/sub pi/, it was found that the decay waves propagated along the pump wave rather than in the Vector E sub 0 x Vector B direction. This is in agreement with the recent theoretical predictions of finite length stabilization. ERA

N78-27944# Princeton Univ., N. J. Plasma Physics Lab.
HAMILTON'S PRINCIPLE FOR A HYDROMAGNETIC FLUID WITH A FREE BOUNDARY
R. L. Dewar Mar. 1978 49 p refs
(Contract EY-76-C-02-3073)
(PPPL-1421) Avail: NTIS HC A03/MF A01

Newcomb's nonlinear formulation of Hamilton's principle for an ideal hydromagnetic fluid surrounded by a wall is generalized to allow vacuum and ferromagnetic regions, and to include the effects of external conductors and circuits. The linear approximation is recovered by expanding to second order in the plasma displacement. When the accumulated charge flowing in each conductor is treated as a generalized variable, the vacuum energy appears as a kinetic energy, with the inductance matrix appearing in the role of a mass tensor. A subsidiary variational principle is used to determine the inductance matrix, thus providing an alternative to the Green's function method. ERA

N78-27945# Princeton Univ., N. J. Plasma Physics Lab.
PLASMA RESPONSE TO SYMMETRY BREAKING PERTURBATIONS IN THE REVERSED FIELD GEOMETRY
A. H. Boozer Feb. 1978 15 p refs
(Contract EY-76-C-02-3073)
(PPPL-1419) Avail: NTIS HC A02/MF A01

Field reversal does not insure closure of the reversed field geometry. The closure is critically dependent on the shape of the toroidal field B sub 1 vector. The plasma diamagnetic currents are shown to establish a spacial scale for the field B sub 1

vector which is lambda approximately equal to a/square root of beta sub 1 with a the plasma radius and beta sub 1 the plasma beta relative to the B sub 1 vector field. ERA

N78-27946# Texas Univ., Austin. Center for Electromechanics.
METHODS FOR PRODUCING THE PLASMA INITIATION PULSE IN OHMIC HEATING CIRCUITS IN TOKAMAK POWER REACTORS: RESISTIVE DISSIPATION, TRANSIENT INDUCTIVE STORAGE, AND TRANSIENT CAPACITIVE STORAGE
M. D. Driga, D. J. Mayhall, W. F. Weldon, H. G. Rylander, and H. H. Woodson 1977 5 p refs Presented at 7th Symp. on Fusion Res. Project, Knoxville, Tenn., 25 Oct. 1977
(Contract EG-77-S-05-5594)
(CONF-771029-120) Avail: NTIS HC A02/MF A01

The resistive dissipation method is compared with inductive and capacitive transient storage methods. The capacitive method is relatively well known through its variant, the Inall circuit. The inductive transient storage method to produce the plasma initiation pulse consists of two closely coupled coils, one connected with a system of differentially compounded slow discharge homopolar machines. The magnetic energy is suddenly taken from the ohmic heating circuit and temporarily stored in the mutual inductance of the two coils--thus producing the pulse. ERA

N78-27947# Oak Ridge National Lab., Tenn.
SMALL RADIUS START-UP OF TOKAMAK PLASMAS WITH A MOVING LIMITER
T. Uckan Dec. 1977 29 p refs
(Contract W-7405-eng-26)
(ORNL-TM-6111) Avail: NTIS HC A03/MF A01

The problem of start-up for a large size Tokamak plasma is studied with a moving limiter. The plasma transport with the presence of the electric field diffusion and heat conduction losses is investigated analytically by the separation of variables during this early phase of the discharge. The results are then applied to a TNS-size plasma. It is shown that a moving limiter may help ameliorate the possible problem of skin effects on the current profile. ERA

N78-27948# Los Alamos Scientific Lab., N. Mex.
SYSTEM OF NONLINEAR PARTIAL DIFFERENTIAL EQUATIONS DESCRIBING CYLINDRICAL COLLAPSE
Alfred Carasso (New Mexico Univ., Albuquerque) and B. R. Suydam Feb. 1978 30 p refs
(Contract W-7405-eng-36)
(LA-6824) Avail: NTIS HC A03/MF A01

The snow-plough model is considered for describing cylindrical plasma collapse for a specified constant driving term. This coupled nonlinear system consists of five partial diffferential equations in two independent variables, one of which is the time variable. It was shown that by direct construction of the unique solution, explicitly in terms of the initial data, the solution exists for all positive times and is generally an infinitely differentiable function of the independent variables. Nevertheless, the solution always developed a nonphysical singularity after a certain positive time, and thereafter ceases to describe the underlying physical situation. The theory leads to an a priori bound in terms of the initial data, on the time interval during which the snow-plough model is physically realistic. ERA

N78-27949# Princeton Univ., N. J. Plasma Physics Lab.
STUDY OF DISRUPTIVE INSTABILITIES IN THE PLT TOKAMAK USING X-RAY TECHNIQUES
N. R. Sauthoff, S. VonGoeler, and W. Stodiek Jan. 1978 54 p refs
(Contract EY-76-C-02-3073)
(PPPL-1379) Avail: NTIS HC A04/MF A01

An array of surface barrier X-ray detectors was used to analyze the plasma cross section along 20 chords. A wide variety of phenomena were classified based upon: (1) the severity of the disruption; (2) the dominant precursor oscillations; and (3) the location of the onset of the disruption. Minor disruptions in which the disruption did not appear at the location of the island of the precursor oscillation were observed, sometimes accompanied by seemingly independent higher frequency oscillations of different helicity localized near the point of the disruption. Major disruptions exhibited flatter central q-profiles, slowing the oscillations, asymmetry with respect to the center of the discharge, and a correlation with high-Z impurity radiation. ERA

N78-27950# Princeton Univ., N. J. Plasma Physics Lab.
PLASMA EDGE COOLING DURING RF HEATING
S. Suckewer and R. J. Hawryluk Jan. 1978 14 p refs
(Contract EY-76-C-02-3073)
(PPPL-1416) Avail: NTIS HC A02/MF A01

A new approach to prevent the influx of high-Z impurities into the core of a Tokamak discharge by using RF power to modify the edge plasma temperature profile is presented. This concept is based on spectroscopic measurements on PLT during ohmic heating and ATC during RF heating. A one dimensional impurity transport model is used to interpret the ATC results. ERA

N78-27951# California Univ., Livermore. Lawrence Livermore Lab.
TARGET-PLASMA PRODUCTION BY LASER IRRADIATION OF A PELLET IN THE BASEBALL II-T EXPERIMENT
C. C. Damm, J. H. Foote, A. H. Futch, R. K. Goodman, R. S. Hornady, J. E. Osher, and G. D. Porter 14 Nov. 1977 19 p refs
(Contract W-7405-eng-48)
(UCRL-52363) Avail: NTIS HC A02/MF A01

A CO2 laser was used to provide a two-sided irradiation of an ammonia pellet; Th 150 micron m-dia pellets were guided to the laser focal spot in the Baseball II-T magnetic field using steering voltages controlled by a microcomputer-based system. Diagnostics showed complete ionization of the pellet, average ion energies in the keV range, synchronized triggering of the laser and the neutral beam, and rapid expansion of the plasma to a diameter that was a good match to the diameter of the neutral beam. Predictions obtained from the LASNEX code compared well with measured results. Although the laser-pellet approach was proven usable as a target-plasma startup system, it would be much more complicated and expensive than the method in which streaming plasma is used to trap the neutral beams. ERA

N78-27952# Wisconsin Univ., Madison. Dept. of Nuclear Engineering.
USE AND PERFORMANCE OF GRAPHITE AND METAL ISSECS IN TOKAMAK FUSION REACTORS
H. I. Avci, Y. Gohar, T. Y. Sung, G. L. Kulcinski, and C. W. Maynard Apr. 1977 103 p refs
(Contract EY-76-S-02-2272)
(UWFDM-202) Avail: NTIS HC A06/MF A01

The internal spectral shifter and energy converter (ISSEC) concept is expanded to the area of high temperature refractory metals. The effects are studied in a cylindrical geometry blanket model and the effects of breeding tritium are included. The more realistic mechanical and heat transfer design characteristics of ISSECs are dealt with. The calculation method is described and the model blanket design used is presented. The way various ISSECs affect the 316 SS first structural wall radiation damage parameters is shown. The effects of ISSECs on the parameters characterizing the whole blanket, e.g., tritium breeding ratio, energy multiplication, radioactivity are outlined. The radiation damage inside the ISSECs themselves is elaborated on. Construction methods are investigated, as well as the associated heat transfer and stress problems. ERA

N78-27953# Oak Ridge National Lab., Tenn. Fusion Energy Div.
ORNL FUSION POWER DEMONSTRATION STUDY: FLUID FLOW, HEAT TRANSFER, AND STRESS ANALYSIS CONSIDERATIONS IN THE DESIGN OF BLANKETS FOR FULL-SCALE FUSION REACTORS
A. P. Fraas and A. S. Thompson Feb. 1978 110 p refs
(Contract W-7405-eng-26)
(ORNL-TM-5960) Avail: NTIS HC A06/MF A01

The complex and subtle interplay of conditions imposed on fusion reactor blanket designs by heat transfer, coolant flow thermal stress, fabrication, and maintenance considerations were examined. Particular attention was given to possible hot spot

effects that might stem from aberrant behavior of the plasma. The results of the study indicate that a lithium-cooled niobium blanket structure withstands ten to twenty times more severe first wall heating conditions than a helium-cooled stainless steel structure. The blanket design employing a recirculating lithium-cooled niobium structure that appeared most promising from the heat transfer, stress analysis, and coolant flow standpoints is then reviewed from the standpoints of fabricability, cost, and maintenance and found to be competitive with or superior to the several helium-cooled blanket designs considered in the study. ERA

N78-27954# Oak Ridge National Lab., Tenn. Fusion Energy Div.

LARGE COIL TEST FACILITY CONCEPTUAL DESIGN REPORT

L. W. Nelms, P. B. Thompson, and T. L. Mann Feb. 1978 137 p refs

(Contract W-7405-eng-26)

(ORNL-TM-6032) Avail: NTIS HC A07/MF A01

A conceptual design was completed for a facility to test D-shaped TF coils, 2.5 x 3.5 m bore, operating a 4-6 K, cooled either by boiling helium or by forced-flow supercritical helium. The principal components and systems in the facility are an 11 m vacuum tank, a test stand providing structural support and service connections for the coils, a liquid nitrogen system, a system providing helium both as saturated liquid and at supercritical pressure, coils to produce a pulsed vertical field at any selected test coil position, coil power supplies, process instrumentation and control, coil diagnostics, and a data acquisition and handling system. The test stand structure is composed of a central bucking post, a base structure, and two horizontal torque rings. The coils are bolted to the bucking post, which transmits all gravity loads to the base structure. The torque ring structure, consisting of beams between adjacent coils, acts with the bucking structure to react all the magnetic loads, that occur when the coils are energized. ERA

N78-27955# Oak Ridge National Lab., Tenn. Fusion Energy Div.

ORNL TNS PROGRAM: PLASMA ENGINEERING CONSIDERATIONS AND INNOVATIONS FOR A MEDIUM FIELD TOKAMAK FUSION REACTOR

Y. K. M. Peng, S. E. Attenberger, W. A. Houlberg, A. T. Mense, J. A. Rome, and N. A. Uckan Dec. 1977 30 p refs

(Contract W-7405-eng-26)

(ORNL-TM-6150) Avail: NTIS HC A03/MF A01

Recent plasma engineering studies ascertained a viable concept for The Next Step(TNS) reactor based on medium toroidal fields between 4 T and 7 T at the plasma center, plasma anti Beta values up to 10%, and average densities between 0.6 x 10 to the 14th power/cu cm and 2.5 x 10 to the 14th power/cu cm. Plasma engineering innovations that can substantially reduce the size, cost, and complexity of the TNS reactor were explored and are summarized. It is shown that the previously anticipated requirement of high pellet velocities can be substantially reduced; the toroidal field(TF) ripple requirements may be relaxed to reduce the number of TF coils and improve machine access; hybrid equilibrium field(EF) coils were shown to require building only small interior coils; and to reduce the power supply required by the exterior coils; proper approaches of microwave plasma preheating may reduce the peak loop voltage for start-up by an order of magnitude. ERA

N78-27956# Princeton Univ., N. J. Plasma Physics Lab.

CLASSICAL DIFFUSION IN THE PRESENCE OF AN X POINT

S. P. Auerbach and A. H. Boozer Jan. 1978 48 p refs

(Contract EY-76-C-02-3073)

(PPPL-EPRI-7) Avail: NTIS HC A03/MF A01

Classical plasma diffusion is studied in a two-dimensional system with an X point, the third dimensional (the Z axis) being a symmetry direction. Several exact results are presented which give a good qualitative understanding of the diffusive flow in such a system. A soluble model which illustrates these results is also given. These results may be summarized as follows: (1) the pressure gradient dP/d Psi (Psi is the poloidal flux) does not vanish on the separatrix; i.e., the diffusion coefficient D(Psi) is finite there. (2) Neglecting viscous or inertial effects, the poloidal flow follows lines of constant Hamada angle. This has the consequence that all flow across the separatrix is channelled through the X point, and the flow velocity along the separatrix is formally infinite. The inclusion of viscous or inertial effects would remove this singularity while modifying the flow only in a small boundary layer region near the separatrix. ERA

N78-27957# Wisconsin Univ., Madison. Dept. of Nuclear Engineering.

TOROIDAL FIELD MAGNET SYSTEM UTILIZING NORMAL METAL TRIMMING COILS

P. F. Michaelson, S. O. Hong, W. C. Young, I. N. Sviatoslavsky, and R. W. Conn 1977 8 p refs Presented at the 5th Symp. on Eng. Probl. of Fusion Res., Knoxville, Tenn., 25 Oct. 1977

(Contract EY-76-C-02-2272)

(UWFDM-225; Conf-771029-205) Avail: NTIS HC A02/MF A01

A conceptual design of a Tokamak toroidal field (TF) magnet system with trimming coils to reduce field ripple throughout the plasma region is presented. The number and size of superconducting TF coils is reduced from conventional designs to provide more access for maintenance, blanket cooling, vacuum pumping and plasma heating schemes and to improve the operating economics. The resulting large toroidal field ripple is trimmed with normal copper coils located close to the plasma. Saddle shaped and ring shaped trimming coils are described. In addition to its primary function of trimming, a ring shaped normal coil also can be used to supply a fair amount of magnetic field strength to augment the maximum fields available from the superconducting coils. The cooling scheme, material selection, number, size, shape and placement of the superconducting coils and the trimming coils are discussed. ERA

N78-27958# Westinghouse Electric Corp., Pittsburgh, Pa. Fusion Power Systems Dept.

TRADE STUDY ANALYSIS FOR TNS TOKAMAKS

D. L. Chapin, H. J. Garber, D. A. Sink, and G. Gibson 1977 22 p refs Presented at the 7th Symp. on Eng. Probl. of Fusion Res., Knoxville, Tenn., 25-28 Oct. 1977

(Contract W-7405-eng-26)

(WFPS-TME-056; Conf-771029-208) Avail: NTIS HC A02/MF A01

A series of parametric trade studies was performed to consistently evaluate the relative costs and performance parameters of D-T burning Tokamaks over a range of plasma sizes and toroidal field (TF) coil technologies. Four different types of TF coil technologies were investigated: water-cooled copper coils, superconducting NbTi and Nb3Sn coils, and a hybrid coil arrangement consisting of a normal conducting Cu coil nested within a superconducting NbTi coil. Results of the analysis indicate for TNS operation, for example, that for a given plasma beta at ignition, the Cu TF coil devices are least expensive, followed by the Nb3Sn, NbTi, and NbTi/Cu options. Other conclusions and trends resulting from the study are presented and analyzed. ERA

N78-27959# Westinghouse Electric Corp., Pittsburgh, Pa. Fusion Power Systems Dept.

LATERAL SUPPORT STRUCTURE FOR CONSTANT TENSION D-SHAPED COILS IN TOKAMAK FUSION DEVICES

R. Fernandes 1977 17 p refs Presented at 7th Symp. on Eng. Probl. of Fusion Res., Knoxville, Tenn., 25-28 Oct. 1977

(Contract W-7405-eng-26)

(WFPS-TME-063; Conf-771029-201) Avail: NTIS HC A02/MF A01

Structural analyses were performed to optimize the geometry of the lateral support structure required to withstand the vertical field loading on the toroidal field (TF) coils which results in lateral forces and overturning moments on each TF coil and produces slope distortions of the coil which tend to perturb the magnetic field. The optimization study shows that the most effective region for the lateral support structure is the space currently intended for the neutral beam window near the horizontal midplane. Lateral supports which did not occupy this space resulted in coil slope distortions in excess of ten milliradians while those that did yielded distortions of about one milliradian. An examination of the reactive force distribution on the lateral

support structure indicates that a combination of radial and circumferential shear panels would be appropriate since it would provide space for the neutral beam window at an angle to the horizontal midplane, and, additionally, limit coil slope distortions. ERA

N78-27960# Westinghouse Electric Corp., Pittsburgh, Pa. Fusion Power Systems Dept.
STRUCTURAL ANALYSIS METHODS AND DESIGN SOLUTIONS FOR OHMIC HEATING SOLENOIDS
R. A. Smith Sep. 1977 19 p refs
(Contract W-7405-eng-26)
(WFPS-TME-045) Avail: NTIS HC A02/MF A01

Design equations with solutions are derived for the ohmic heating coil solenoid unique to a Tokamak fusion device. The solutions are provided to perform a detailed structural analysis of every conducting turn in the radial build of the solenoid. The derivations follow from the theory of elasticity for a body possessing cylindrical anisotropy where the material properties are different in the radial and tangential directions. Distinction is made to provide separate models for the region of the solenoid where turn-to-turn radial contact is maintained with radial compression or with a bond tensile strength in regions of radial tension, and where there is turn-to-turn radial separation due to the absence or the loss of bonding in locations of would-be radial tension. ERA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N78-27961 Texas Univ. at Austin.
THE ROLE OF THE DEFORMATION POTENTIAL IN A SELF-CONSISTENT CALCULATION OF ULTRASONIC ATTENUATION IN COPPER Ph.D. Thesis
William Michael Theis 1977 142 p
Avail: Univ. Microfilms Order No. 78-07396

The experiment of Khatri and Peverley using shear waves in copper to investigate its transport properties by observing the attenuation of ultrasound by conduction electrons was repeated to ensure that the observed phenomena of both resonance and anti-resonance behavior were not merely experimental artifacts. The fundamental resonance (which occurred at a field inaccessible to Khatri and Peverley) is a peak for polarization in the (112) direction and a dip for a (110) polarization. The data obtained showed enhancement of odd resonances for the first case and the reverse situation for the latter. A Fourier decomposition of the energy shifts caused by strain along the orbit direction, allowed a simplification of the analysis of ultrasonic attenuation. Closed orbits present in copper were modeled by free electrons. Results indicate that the enhancement of even or odd resonances is due to symmentry properties of the deformation force. Dips in the attenuation were not found. Dissert. Abstr.

N78-27962 Cornell Univ., Ithaca, N. Y.
KINETIC STUDIES OF THE LOW-LYING ELECTRONIC STATES OF GASEOUS GERMANIUM AND TIN ATOMS Ph.D. Thesis
Maria Josephine Yuen 1978 139 p
Avail: Univ. Microfilms Order No. 7809320

Transient, optically metastable gaseous tin atoms were generated by pulsed irradiation of Sn-Me4 and monitored photoelectrically in absorption by the time-resolved attentuation of atomic resonance radiation derived from a microwave-powered discharge. Modification of the lifetime of two spin-orbit states by added Ar, Kr, Xe, H2, D2 and HD was studied and led to absolute rate constants for these processes at 300 K. The reactivity of ground state Ge and Sn with N2O, Cl2, O2, COS, NO2, NO, BCl3 and PCl3 was determined. The metal atoms were produced by white light photolysis of SnMe4, SnCl4 or GeCl4 and were monitored in the same fashion as the spin-orbit states of Sn. Consideration of the reactions with Cl2, and O2 show that the reactions proceed via a stable complex to form ground state metal chlorides and metal oxides. Dissert. Abstr.

N78-27963 Wisconsin Univ., Madison.
SPIN DENSITY CALCULATIONS Ph.D. Thesis
James Joseph Tortorelli 1978 327 p
Avail: Univ. Microfilms Order No. 7804887

Ab initio spin density distributions in small model systems are investigated. Development of the pertinent theory and notation is followed by a study of the dependence of the ground state H2(+) proton spin density upon internuclear separation. The hyperfine dipole interaction is also considered. Approximate wave functions derived from Gaussian type expansions are then employed in a series of ground state hydrogen atom calculations that explore energy-spin density relationships and their basis set dependence. Slater analogs of large orbital exponent Gaussians are introduced and an approach to the evaluation of electron repulsion integrals over basis sets consisting of these numerically intransigent functions is presented. LiH(+) calculations employing compact Slater orbitals are included. Dissert. Abstr.

N78-27964 Brown Univ., Providence, R. I.
SOME STUDIES OF TRANSITION METAL CHALCOGENIDES AND PNICTIDES Ph.D. Thesis
John Frederick Ackermann 1976 121 p
Avail: Univ. Microfilms Order No. 78-09027

Single crystals of the solid solution series CuFexGe1-xS2 - (0 less than x less than 1.0) were prepared by the chemical vapor transport technique. X-ray diffraction, analysis, and density measurements indicate that all members of this system crystallize with the chalcopyrite structure. Mossbauer spectra show that these crystals contain both iron d(6) and iron d(5) on tetrahedral sites. To determine if former measurements on poor quality powder samples were correct single crystals of the cobalt skutterudites, CoP3, CoAs3, and CoSb3 were prepared by the chemical vapor transport technique using chlorine as the transporting agent. Chemical analysis and density measurements were used to accurately determine the stoichiometry of these crystals. Contrary to earlier reports, CoAs3 and CoSb3 were shown to be metals. Dissert. Abstr.

N78-27965*# North Carolina Univ. at Chapel Hill. Dept. of Physics and Astronomy.
PASSIVE PARTICLE DOSIMETRY Final Report, 17 Nov. 1970 - 30 Jun. 1977
Charles B. Childs 30 Jun. 1977 71 p refs
(Contract NAS8-26601)
(NASA-CR-150739) Avail: NTIS HC A04/MF A01 CSCL 20L

Present methods of dosimetry are reviewed with emphasis on the processes using silver chloride crystals for ionizing particle dosimetry. Differences between the ability of various crystals to record ionizing particle paths are directly related to impurities in the range of a few ppm (parts per million). To understand the roles of these impurities in the process, a method for consistent production of high purity silver chloride, and silver bromide was developed which yields silver halides with detectable impurity content less than 1 ppm. This high purity silver chloride was used in growing crystals with controlled doping. Crystals were grown by both the Czochalski method and the Bridgman method, and the Bridgman grown crystals were used for the experiments discussed. The distribution coefficients of ten divalent cations were determined for the Bridgman crystals. The best dosimeters were made with silver chloride crystals containing 5 to 10 ppm of lead; other impurities tested did not produce proper dosimeters. A.R.H.

N78-27966# Colorado State Univ., Fort Collins. Dept. of Chemistry.
THE JAHN-TELLER EFFECT IN THE LOWEST CHARGE TRANSFER STATE OF UF6
E. R. Bernstein, G. R. Meredith, and J. R. Webb Mar. 1978 35 p refs
(Contract N00014-75-C-1179)
(AD-A053855; TR-18) Avail: NTIS HC A03/MF A01 CSCL 20/10

The neat and mixed crystal emission spectra of UF6 are analyzed. The data are interpreted as being indicative of a substantial molecular Jahn-Teller interaction in the excited charge transfer state. Using a modified Franck-Condon analysis for a 3 dimensional vibrational space, it is found that D(5) is approx 2.02

and that the excited state is distorted along each of three v5 coordinates by roughly 0.09 A. GRA

N78-27967# Brandeis Univ., Waltham, Mass. Dept. of Chemistry.
CRYSTAL AND MOLECULAR STRUCTURE OF (Ni((CH3)2C (OH)CH2COCH3)2) (Ni(NOS)4(P(CH2CH2CN)3)2): A BETA HYDROXYKETONE CHELATE COMPLEX Interim Report
Bruce M. Foxman and Harry Mazurek Feb. 1978 27 p refs Submitted for publication
(Contract N00014-76-C-0822; Grant NSF CHE-76-05582; NR Proj. 053-619)
(AD-A053718; TR-2) Avail: NTIS HC A03/MF A01 CSCL 07/3

The title compound was synthesized and its crystal structure determined by single crystal X-ray diffraction methods. The complex crystallizes in space group P1, with a = 12.773(4), b = 11.421(3), c = 8.864(3) A; alpha = 106.37(5), beta = 78.56(5), gamma = 104.37(5) degrees. Full matrix least squares refinement of positional and thermal parameters for all atoms (3 methyl H atoms fixed), with 3610 reflections led to R = 0.044 and P sub (w) = 0.064. Both cation and anion occupy crystallographic centers of symmetry. In the cation, the beta-hydroxketone ligand is not planar; the hydroxyl oxygen atom and beta-carbon atom lie +0.40 and -0.38 A out of the plane containing Ni and the other ligans atoms. The Ni-O distances to the carbonyl and hydroxyl oxygen atoms are 1.895(3) and 1.927(3) A, respectively. The anion is trans-octahedral; Ni-N-C angles show large distortions from linearity: 160.7(3) and 163.9(3) degrees. GRA

N78-27968# Hughes Research Labs., Malibu, Calif.
OPTICAL-MICROWAVE INTERACTIONS IN SEMICONDUCTOR DEVICES Quarterly Report, 17 Dec. 1977 - 17 Mar. 1978
Huan-Wun Yen and Michael K. Barnoski Apr. 1978 37 p refs
(Contract N00173-77-C-0156)
(AD-A053806; QR-3) Avail: NTIS HC A03/MF A01 CSCL 09/3

Theoretical calculations were carried out to explain the observed results of optical switching of GaAs IMPATT diode oscillators. In the previous experiments it was found that depending on the diode's bias condition, the frequency of oscillation, and the intensity of illumination, the IMPATT microwave output power could be either enhanced or reduced. This problem was treated by carrying out a theoretical calculation of the property of IMPATT diode under optical illumination. It was determined that the most significant contribution of optical illumination in an IMPATT diode is the drastic increase in reverse saturation current Is. Using small signal analysis we obtained an expression for the total impedance of the IMPATT diode under optical illumination. It was found that optical illumination causes the shifting of the negative resistance and reactance versus frequency curves. This in turn causes the oscillation frequency to vary and the output power to drop in general. However, the cavity tuning yields a strongly frequency dependent threshold for the diode. Therefore, under certain circumstances, optical illumination can actually trigger the IMPATT diode into oscillation also. Author (GRA)

N78-27969# California Univ., Berkeley. Lawrence Berkeley Lab.
LOW FREQUENCY NOISE IN METAL FILMS AT THE SUPERCONDUCTING TRANSITION, 2. RESISTANCE OF SUPERCONDUCTOR - NORMAL METAL - SUPERCONDUCTOR SANDWICHES AND THE QUASIPARTICLE RELAXATION TIME Ph.D. Thesis
T. Y. Hsiang Jul. 1977 176 p refs
(Contract W-7405-eng-48)
(LBL-6611) Avail: NTIS HC A09/MF A01

The noise power spectra of tin and lead films at the superconducting transition were measured in the frequency range of 0.1 Hz to 5k Hz using samples evaporated directly onto glass substrate, or evaporated onto glass or sapphire substrate with a 50A aluminum underlay. The results are consistent with a thermal diffusion model which attributes the noise to the intrinsic temperature fluctuation in the metal film driven with a random energy flux source. The resistance of superconductor normal metal-superconductor sandwiches near T/sub c/ was investigated. The increase in SNS resistance is attributed to the penetration of normal electric current in the superconductor. The electric field inside S days according to a diffusion law. The diffusion length is determined by the quasiparticle 'branch-crossing' relaxation time. The branch-crossing relaxation times ere measured. Impurity-doping of tin was found to decrease the relaxation time. ERA

N78-27970# Eyring Research Inst., Provo, Utah.
LIQUID RIBBON ELECTRODES FOR POCKELS CELLS Final Report
James M. Thorne and Kenneth Lee Matheson Dec. 1977 42 p refs
(Contract W-7405-eng-48)
(UCRL-13798) Avail: NTIS HC A03/MF A01

Several highly conductive solutions for use as electrodes for Pockels cells are described. For example, one with the same refractive index as KD2PO4 is composed of 24 volume percent acrylonitrile in benzonitrile and is 0.65 molar in silver perchlorate hydrate. It has a resistivity of 48.5 ohm-cm. Other compositions are described having the same refractive index as fused quartz, or index to minimize the Fresnel reflection from a Pockels cell with uncoated fused quartz windows. The liquids have optical transmissions greater than 99.9 percent at 1.06 micron in thickness less than 0.1 mm. The nonlinear refractive indexes of the liquids appear to be less than 5 x 10 to the minus 13 power esu. The parameters which are important in developing liquid ribbon electrodes are identified and gaged with a limited amount of data. The best solvents for liquid ribbon electrodes are identified and listed. Excellent electrolytes are also listed, but it is not clear that better ones will not be found by a more extensive search. ERA

N78-27971# Xerox Palo Alto Research Center, Calif.
OPTICAL PROBES OF THE LATTICE DYNAMICS OF GRAPHITE
R. J. Nemanich, S. A. Solin, and G. Lucovsky 1977 15 p refs Presented at Franco-American Conf. on Intercalated Compounds of Graphite, La Napoule, France, 27 May 1977
(Contract EY-76-S-02-2126)
(COO-2126-38; Conf-770587-1) Avail: NTIS HC A02/MF A01

First and second order Raman and first order infrared reflectance spectra of highly oriented pyrolytic graphite (HOPG) were obtained for both E parallel to c and E perpendicular to c. From the infrared measurement the A/sub 2 u/ out of plane mode is identified for the first time and occurs at 868/cm. The macroscopic effective changes of both the A/sub 2 u/ and E/sub 1 mu/modes were calculated. The second order Raman spectra were recorded for graphite forms of various crystallite sizes. The second order Raman spectra for both HOPG and single crystal graphite exhibit an anomalously sharp feature at 3248/cm which is sharper than the first order zone center E/sub 2g/ band at 1581/cm. Of the six recent and in some cases mutually inconsistent lattice dynamics calculations on graphite, only that due to Nicklow et al. is compatible with the 3248/cm feature, and even that model does not provide a satisfactory explanation of the second order spectrum. ERA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N78-27972# Los Alamos Scientific Lab., N. Mex.
MAXIMUM ENTROPY ANALYSIS FOR SOME ONE- AND TWO-DIMENSIONAL PROBLEMS
J. E. Brolley, R. B. Lazarus, B. R. Suydam, and H. J. Trussell 1977 15 p refs Presented at the Digital Process. Symp., Albuquerque, N. Mex., 6-7 Dec. 1977

(Contract W-7405-eng-36)
(LA-UR-77-2689; Conf-771206-20) Avail: NTIS HC A02/MF A01

Applications of the P log P method of time series analysis to one and two dimensional problems are illustrated with emphasis on circular functions and digitized computations. The arguments, however, can be applied to other classes of functions as well as analog systems. The formalism for determining the most probable distribution of initial energy sources from the output of a series of filters is delineated. Operation on a sine wave and the image of a pinhole camera are examined. ERA

N78-27973# Sandia Labs., Albuquerque, N. Mex.
CHILES 2: A FINITE ELEMENT COMPUTER PROGRAM THAT CALCULATES THE INTENSITIES OF LINEAR ELASTIC SINGULARITIES IN ISOTROPIC AND ORTHOTROPIC MATERIALS
S. E. Benzley and Z. E. Beisinger Feb. 1978 48 p refs
(Contract EY-76-C-04-0789)
(SAND-77-1900) Avail: NTIS HC A03/MF A01

A generalized quadrilateral finite element that includes a singular point at a corner node is incorporated in the CHILES 2 code. The displacement formulation is used and interelement compatibility is maintained so that monotone convergence is preserved. Plane stress, plane strain, and axisymmetric conditions are treated. Isotropic and orthotropic crack tip singularity problems are solved by this version of the code, but any type of singularity may be properly modeled by modifying selected subroutines in the program. ERA

N78-27974# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
MEASUREMENTS OF COMBINED AXIAL MASS AND HEAT TRANSPORT IN He II
Warren W. Johnson and Michael C. Jones Feb. 1978 84 p refs
(PB-279058/2; NBS-TN-1002) Avail: NTIS HC A05/MF A02 CSCL 20M

The steady-state combined heat transport and fluid flow of the superfluid phase of helium 4 through a long tube is studied by measurements of both axial mass and heat transport. For the larger Reynolds numbers, it was found that the relation between pressure difference and net fluid velocity was nearly indistinguishable from that of an ordinary fluid in turbulent flow. The axial heat transported was found to be suppressed from the values that were calculated by assuming that mutual friction was unchanged by the net fluid flow, but it was always found to be larger than the enthalpy rise value. GRA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N78-27975# Battelle Pacific Northwest Labs., Richland, Wash. Battelle Human Affairs Research Centers.
MANAGEMENT OF SOCIAL AND ECONOMIC IMPACTS ASSOCIATED WITH THE CONSTRUCTION OF LARGE-SCALE PROJECTS: EXPERIENCES FROM THE WESTERN COAL DEVELOPMENT COMMUNITIES
Marjorie R. Greene and Martha G. Curry Jun. 1977 55 p refs
(Contract EY-76-C-06-1830)
(BNWL-RAP-16) Avail: NTIS HC A04/MF A01

An introductory analysis to some of the more complex issues raised by social and economic impact management, with experiences cited from Western coal-development communities is provided. Following an introduction, the paper is divided into sections corresponding to the major social and economic impacts experienced by rural communities surrounding an energy development. Each section contains a brief introductory description of the types of problems typically associated with the impact sector, and a discussion of management strategies either proposed or implemented for the impact. The management strategies are presented in tabular form, indicating the level of government responsible for implementation. Author

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N78-27976*+ National Aeronautics and Space Administration, Washington, D. C.
MANAGEMENT: A CONTINUING LITERATURE SURVEY WITH INDEXES
Mar. 1978 207 p refs
(NASA-SP-7500(12)) Avail: NTIS HC A10 CSCL 05A

This bibliography lists 782 reports, articles, and other documents introduced into the NASA scientific and technical information system in 1977. The citations, and abstracts when available, are reproduced exactly as they appeared originally in IAA and STAR, including the original accession numbers from the respective announcement journals. Topics cover the management of research and development contracts, production, logistics, personnel, safety, reliability and quality control citations. Includes references on: program, project and systems management; management policy, philosophy, tools, and techniques; decision-making processes for managers; technology assessment; management of urban problems; and information for managers on Federal resources, expenditures, financing, and budgeting. A.R.H.

N78-27977*# National Aeronautics and Space Administration, Washington, D. C.
THE WRITERS GUIDE TO NASA
[1978] 32 p
(NASA-TM-79517) Avail: NTIS HC A03/MF A01 CSCL 05A

NASA services of interest to writers and to the news media include personal interviews, daily audio reports of major missions, and projects via automated telephone, research assistance from historians or history monitors at technical libraries, the use of a collection of historical photographs, and the free loan of sound films of NASA research and development activities. The names and phones numbers are listed for public affairs contacts at Headquarters and at each of the major centers and their component installations. An overview of the six NASA program offices is included along with a vicinity map of each center and a description of their facilities and management responsibilities. A.R.H.

N78-27978# Naval Postgraduate School, Monterey, Calif.
A SUMMARY OF THE FOUNDATION RESEARCH PROGRAM Summary Report, 1 Jul. 1976 - 30 Sep. 1977
Mar. 1978 75 p
(AD-A053870; NPS-012-001PR) Avail: NTIS HC A04/MF A01 CSCL 05/1

Thirty-eight summaries of Independent Research/Independent Exploratory Development work carried out under funding to the Naval Postgraduate School Foundation Research Program. This research was carried out in the areas of Mathematics, Administrative Science, Operations Research, National Security Affairs, Physics and Chemistry, Electrical Engineering, Meteorology, Aeronautics, Oceanography, and Mechanical Engineering. A tabulation in the appendix 1 identifies area of research and the principal investigator. The category of independent research or independent exploratory research is also identified for each research task. Author (GRA)

N78-27979# Wright State Univ., Dayton, Ohio. Dept. of Administrative Science and Finance.
ON THE BENEFIT-TO-COST RATIO OF BASE-LEVEL STOCKING DECISIONS FOR LOW DEMAND ITEMS Interim Report
W. Steven Demmy, Russell M. Genet, Thomas D. Meitzler, and Ross E. Miles Apr. 1978 22 p
(Grant AF-AFOSR-3011-76)
(AD-A053953; WP-76-3011-19) Avail: NTIS HC A02/MF A01 CSCL 15/5

This paper explores a fundamental cause of aircraft non-availability. It shows that for current Air Force aircraft, a significant portion of the lack of supply availability is due to not stocking items at the base level. Basic research on methods to alleviate this problem in a cost-effective way is reported. It is shown,

with specific, real world examples, how these methods can be applied to current inventory aircraft. Author (GRA)

N78-27980# Decisions and Designs, Inc., McLean, Va.
DECISION THEORETIC AIDS FOR INFERENCE, EVALUATIONS, AND DECISION MAKING: A REVIEW OF RESEARCH AND EXPERIENCE
Gregory W. Fischer, Clinton W. Kelly, III, and Ward Edwards Feb. 1978 148 p refs
(Contracts N00014-76-C-0074; F33615-73-C-4056)
(AD-A053962; TR-78-1-30) Avail: NTIS HC A07/MF A01 CSCL 05/10

Over the past twenty years, there has been increasing emphasis on research concerned with human decision making abilities and with the development of formal methods to aid decision makers in reaching logically consistent choices. This broad area of research is of particular importance in national security contexts where key decision makers must resolve extremely complex decision problems characterized by uncertainty, conflicting information, and enormously high stakes. This technical report presents a summary of major portions of the literature bearing on people's ability to process information and to reach decisions. It also contains a review of laboratory and field assessments of judgmentally-based decision aiding systems embodying decision analytic concepts. GRA

N78-27981# Mitre Corp., Bedford, Mass.
THE PENTAGON FOUR-STEP
Norman Waks Mar. 1978 28 p refs
(AD-A053963; MTP-190) Avail: NTIS HC A03/MF A01 CSCL 05/1

In the Secretary of Defense's Annual Report for FY '79 to the Congress, released on 2 February 1978, he indicated that the Department of Defense (DoD) was currently testing a new concept for contractor source selection on major programs called the 'four-step' process. He further indicated that a decision would be made in February on whether DoD would adopt this process. DoD's encouragement of the publication by the Wall Street Journal of a favorable article on the subject on 6 March would seem to indicate that this decision has been made and that DoD intends to go ahead and adopt the concept as a matter of policy. This paper questions both the desirability and the necessity for DoD to do so, since the objectives of 'four-step' can be accomplished in other ways. And these ways do not risk reducing program results, as 'four-step' does. Author (GRA)

N78-27982# Los Alamos Scientific Lab., N. Mex.
PROBABILITY DISTRIBUTION OF BIDS ON OUTER CONTINENTAL SHELF OIL AND GAS LEASES
L. A. Bruckner and M. M. Johnson Mar. 1978 22 p refs
(Contract W-7405-eng-36)
(LA-7190-MS) Avail: NTIS HC A02/MF A01

The bids on oil and gas leases on the outer continental shelf are usually treated as observations from a lognormal probability distribution. Occasionally, and alternative distribution. It is demonstrated that the number of bids received on a lease is too small to distinguish clearly among possible underlying distributions. It is shown that the beta and the log-uniform distrubutions often cannot be rejected as unreasonable hypotheses. ERA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N78-27983* + National Aeronautics and Space Administration, Washington, D. C.
NASA PATENT ABSTRACTS BIBLIOGRAPHY: A CONTINUING BIBLIOGRAPHY. SUPPLEMENT 12, SECTION 1: ABSTRACTS
Jan. 1978 307 p
(NASA-SP-7039(12) Sec 1) Avail: NTIS HC E04 CSCL 05B

This continuing bibliography lists 3292 patents and patent applications introduced into the NASA scientific and technical information system from January 1974 through December 1977. Each entry consists of a citation, an abstract, and, in most cases, a key illustration selected from the document. Author

N78-27984* + National Aeronautics and Space Administration, Washington, D. C.
NASA PATENT ABSTRACTS BIBLIOGRAPHY: A CONTINUING BIBLIOGRAPHY. SUPPLEMENT 12, SECTION 2: INDEXES
Jan. 1978 568 p
(NASA-SP-7039(12)-Sec-2) Avail: NTIS HC E06 CSCL 05B
For abstract, see N78-27983.

N78-27985# Federal Computer Performance Evaluation Simulation Center, Washington, D. C.
MV-027-033-ARMY EVALUATION OF DBMS MODELING APPROACHES
Feb. 1978 144 p refs
(AD-A053829) Avail: NTIS HC A07/MF A01 CSCL 05/1

This report presents the results of FEDSIM's evaluation of the Information Processing System Simulator (IPSS), the Extendable Computer System Simulator (ECSS), and DIMUI -- A Performance Evaluation System for Data Base Management with respect to their data base management system/computer system modeling capabilities, modeling support facilities, and program product qualities. Author (GRA)

N78-27986# Naval Postgraduate School, Monterey, Calif.
A STUDY OF THE SELECTION OF AN INFORMATION FLOW AND ANALYSIS SYSTEM FOR NAVAL UNDERWATER SYSTEMS CENTER M.S. Thesis
Gordon Calvert Lannou, Jr. Mar. 1978 125 p refs
(AD-A053851) Avail: NTIS HC A06/MF A01 CSCL 05/9

The Naval Underwater Systems Center, located in New London, Conn., needs an Information Flow and Analysis System (IFAS) for the Sonar Operational Training and Assessment Program (SOTAP). This study addresses the requirements for sonar operational programs. It discusses basic differences between weapons and information systems, and proposes a systems approach for the acquisition of a basic management information system. It presents the information system alternatives available to the SOTAP management and describes the existing information system, Personnel Training and Evaluation Program (PTEP). It discusses PTEP's FY 78 incorporation into the Navy's Versatile Training System (VTS) and how PTEP may be expanded and changed under VTS to include the sonar rating aboard Fleet Ballistic Missile (FBM) submarines with the end goal of improving ultimate user; sonar technicians, knowledge and performance of sonar weapons systems. GRA

N78-27987# Los Alamos Scientific Lab., N. Mex.
USING SYSTEM 2000 WITH PROPOSED ANSI STANDARDS FOR THE DATA EXCHANGE
Carmen M. Benkovitz and Richard A. Wiley 1977 27 p Presented at the Assoc. of System 2000 Users for Tech. Exchange Fall Conf., San Francisco, 17-19 Oct. 1977
(Contract W-7405-eng-36)
(LA-UR-77-2739; Conf-771074-2) Avail: NTIS HC A03/MF A01

In 1976 the Energy Research and Development Administration (ERDA) Interlaboratory Working Group for Data Exchange developed a standard for the generalized exchange of data bases using magnetic tape. This, subsequently, became the proposed American National Standard Specifications for an Information Data Descriptive File. This report describes the development of a mechanism for conversion of SYSTEM 2000 data bases to or from interchange files conforming to the proposed standard and vice versa. Two phases are discussed. Phase one requires that the user supply the data-base definition, and uses loader string files for conversion. Phase Two will be a completely automated process using the Programming Language Interface. This phase requires no prior knowledge of the data base structure or content at execution time. ERA

N78-27988# Brookhaven National Lab., Upton, N. Y. Dept. of Applied Science.
FACILITATING DATA INTERCHANGE WITH ERDA
C. M. Benkovitz 1977 22 p refs Presented at the VIM 26 Conf., Minneapolis, 3-7 Apr. 1977
(Contract EY-76-C-02-0016)
(BNL-22595; Conf-770445-2) Avail: NTIS HC A02/MF A01

Resources of the seven ERDA multipurpose national laboratories and the advantages of sharing them are pointed out. A standard for the interchange of data among the laboratories was developed. Features of the proposed standard and its implementation are described. Author (ERA)

N78-27989# California Univ., Livermore. Lawrence Livermore Lab.
DATA EXPLOSION: SYMPTOMS, CAUSES, AND CURES
M. R. Posehn and Dennis K. Fisher 2 Feb. 1978 5 p refs Presented at the Inst. of Environ. Sci. 1978 Ann. Meeting, Fort Worth, Tex., 17 Apr. 1978
(Contract W-7405-eng-48)
(UCRL-80713; Conf-780402-2) Avail: NTIS HC A02/MF A01

Computer-based data acquisition/reduction systems for environmental testing can create a large amount of unnecessary data if they are not properly used. This 'data explosion' is often caused by test requests that reflect a lack of understanding of digital systems and is aggravated by batch-oriented data reduction methods. Education directed at the limitations and advantages of digital systems, combined with techniques for real-time data compression and interactive test control, can minimize the amount of data acquired. In addition, the use of an interactive data reduction approach permits selective editing of the test results and presentation in condensed format. ERA

N78-27990# National Technical Information Service, Springfield, Va.
USER NEEDS IN DOCUMENTATION AND INFORMATION, VOLUME 1. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - 1976
Mary E. Young May 1978 200 p
(NTIS/PS-78/0430/5) Avail: NTIS HC $28.00/MF $28.00 CSCL 05B

Reports on meeting the needs of the information sciences user in the most direct and specific way are cited, including methods used to determine those needs and measures taken to fulfill them in application to educational resources, data bases, data management, library networks, photographic recording systems, technical information centers, and consulting services. (This updated bibliography contains 193 abstracts, none of which are new entries to the previous edition.) GRA

N78-27991# National Technical Information Service, Springfield, Va.
USER NEEDS IN DOCUMENTATION AND INFORMATION, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1977 - Apr. 1978
Mary E. Young May 1978 113 p Supersedes NTIS/PS-77/0431; NTIS/PS-76/0325; NTIS/PS-75/189
(NTIS/PS-78/0431/3; NTIS/PS-77/0431; NTIS/PS-76/0325; NTIS/PS-75/189) Avail: NTIS HC $28.00/MF $28.00 CSCL 05B

This updated bibliography contains 106 citations, 71 of which are new entries to the previous edition. For abstract, see N78-27990. GRA

N78-27992# National Technical Information Service, Springfield, Va.
INFORMATION AND COMMUNICATION THEORY, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report
George W. Reimherr Apr. 1978 99217 p Supersedes NTIS/PS-77/0367, NTIS/PS-76/0350, NTIS/PS-75/398, and COM-74-10102
(NTIS/PS-78/0387/7; NTIS/PS-77/0367; NTIS/PS-76/0350; NTIS/PS-75/398; COM-74-10102) Avail: NTIS HC $28.00/MF $28.00 CSCL 09D

This updated bibliography contains 212 abstracts, on government-sponsored research in information and communication theory, including coding, decoding, and transmission of signals. Individual studies are cited on radio, television, and digital communication systems. Pure theory is also included. GRA

N78-27993# National Technical Information Service, Springfield, Va.
AUTOMATED TEXT EDITING. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Mar. 1978
George W. Reimherr Apr. 1978 192 p Supersedes NTIS/PS-77/0369, NTIS/PS-76/0181 and COM-74-10124
(NTIS/PS-78/0391/9; NTIS/PS-77/0369; NTIS/PS-76/0181; COM-74-10124) Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

This bibliography of Federally-funded research presents citations covering automatic text editing and composing. Programming techniques are covered for applications such as report, index, and table generation, as well as list processing. (This updated bibliography contains 185 abstracts, 33 of which are new entries to the previous edition). GRA

N78-27994# Computer Horizons, Inc., Cherry Hill, N. J.
REVIEW AND ANALYSIS OF IMPORTANCE AND UTILIZATION MEASURES CONTAINED IN EVALUATIVE BIBLIOMETRICS Final Report
Paul R. McAllister Feb. 1978 52 p refs
(Grants NSF OAO-76-82854; NSF PRM-76-82854; Proj. 766A)
(PB-278744/8) Avail: NTIS HC A04/MF A01 CSCL 05B

An influence methodology is reported which utilizes the average citation properties for all the papers in a journal as a surrogate for citation counts to individual papers. The citation influence per paper for a journal is the weighted number of times an average paper in that journal is cited. The weighting is such that references from influential journals count more heavily. Citation influence measures have been developed field-by-field for the 2,000 science citation index covered journals in nine major fields. GRA

N78-27995# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Operations Research.
TO DEVELOP AND APPLY MANAGEMENT TECHNIQUES FOR USE IN THE IMPROVEMENT OF THE UNIVERSITY RESEARCH ADMINISTRATION FUNCTION Final Report
Burton V. Dean 14 Nov. 1977 28 p refs
(Contract NSF RMI-74-02639-A01)
(PB-279015/2; TM-432) Avail: NTIS HC A03/MF A01 CSCL 05B

Design and implementation of an improved research administration system is detailed and the organization and dissemination of these concepts to other universities is discussed. The project was performed in four phases: (1) a detailed description of the total research administration system; (2) detailed problem analyses; (3) development of proposal for implementation; and (4) implementation and evaluation of results of the study. GRA

N78-27996# National Bureau of Standards, Washington, D. C.
DIMENSIONS/NBS, VOLUME 62, NO. 3 Monthly Report
Mar. 1978 33 p
(PB-279050/9; NBS-DIM-62-3) Avail: NTIS HC A03/MF A01 CSCL 05B

The table of contents for the current issue is: a problem of growing concern - EMI; copyright and the computer; exploding a metric myth; metric speakers are available; a new director for NBS; cleaner air depends on accurate measurements; stimulated collision-induced fluorescence; laser-Raman probe microanalysis of biological tissue; new phase transition in oxygen; NBS expands data for space shuttle; buoget increase; symposium on radiologic imaging; new computing tools symposium; seminar on testing of solar energy materials and systems; special bullets for indoor firing ranges; flow measurement symposium papers. GRA

N78-27997# National Commission on New Technological Uses of Copyrighted Works, Washington, D. C.
TRANSCRIPT OF NATIONAL COMMISSION ON NEW TECHNOLOGICAL USES OF COPYRIGHTED WORKS
Jan. 1978 200 p Meeting held at Los Angeles, 12-13 Jan. 1978

(PB-280052/2; CONTU-78-0002) Avail: NTIS HC A09/MF A01 CSCL 05B

Testimony given on copyright protection for computer programs is presented as well as summaries of current progress on subcommittee reports. Material on photocopying for corporate, special, and medical libraries is included for the record. GRA

N78-27998# National Technical Information Service, Springfield, Va.

MICROFORMS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Report, 1973 - May 1978

Mary E. Young May 1978 171 p Supersedes NTIS/PS-77/0451; NTIS/PS-76/0442; NTIS/PS-75/0451

(NTIS/PS-78/0435/4; NTIS/PS-77/0451; NTIS/PS-76/0442; NTIS/PS-75/435) Avail: NTIS HC $28.00/MF $28.00 CSCL 14E

Reports on the development and use of microfilm materials are cited in the updated bibliography. Included are microfilm and microfiche format standards, utilization, and care. Much of this is discussed in relation to libraries, information centers, and educational institutions at all levels. GRA

N78-27999# Applied Communication Research, Inc., Stanford, Calif.

EVALUATION OF THE METRO ONLINE SEARCH PROGRAM

Colin K. Mick Feb. 1978 44 p

(Grants NSF SIS-75-11177; NSF DSI-76-01120)

(PB-278532/7) Avail: NTIS HC A03/MF A01 CSCL 05B

An online search service program offered by a large cooperative library network in New York City was evaluated. The system usage is discussed (the number of searches, search topics, search costs) as well as the patrons (who they were, why they requested searches and how they felt about the searches they received). The impact of the search service on the libraries is explored regarding staff time required and librarian reactions to the service. GRA

N78-28034# Joint Publications Research Service, Arlington, Va.

IMPROVING TECHNICAL INFORMATION SERVICES

V. Belousov and I. Zhelezhyaakov *In its* Transl. on USSR Sci. and Technol. (JPRS-71393) 30 Jun. 1978 p 9-12 Transl. into ENGLISH from Tekhn. i Nauka (Moscow), no. 4, 1978 p 31

(For primary document see N78-28033 18-99)

Copyright. Avail: NTIS HC A05/MF A01

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N78-28000# Bechtel Power Corp., San Francisco, Calif.

COMBINED CYCLE POWER PLANT, CAPITAL COST ESTIMATES Final Report

Dec. 1977 67 p

(EPRI-AF-610) Avail: NTIS HC A04/MF A01

Capital cost estimates were prepared for oil-fueled, high-efficiency combined gas turbine/steam turbine power plants in five regions of the United States: Great Lakes, Southwest, Western (at two locations), Northeast, and Southeast. These plants are designed to burn liquid fuels, either distillate (kerosene and No. 2 distillate) or ash-bearing (blended residuals, crudes, and heavy residuals). Plants have either a nominal net combined power output of 250 MWe for a single-unit installation or 500 MWe for a two-unit installation consisting of two 250 MWe units. Capital costs for the 250 MWe plant expressed in 1976 dollars range from $306/kW for a Southwestern plant burning distillate fuel to $417/kW for a remote Western plant burning residual fuel. The costs in $/kW for the 500 MWe plants are about five percent lower. The costs also include an allowance for funds during construction and other owner costs. Trends in future development of combined-cycle plants are also discussed. ERA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N78-28001# Committee on Science and Technology (U. S. House).

NASA AUTHORIZATION, 1979, VOLUME 2, PART 2

Washington GPO 1978 380 p refs Hearings on H.R. 10664 (superseded by H.R. 11401), 95th Congr., 2d Sess., no. 67, 7-8 Feb. 1978

(GPO-26-509) Avail: Subcomm. on Transportation, Aviation and Weather

Current technology efforts and applications of NASA research are described in testimony delivered and statements received for the record in support of NASA program funding requests. Topics covered include systems development, experimental programs, and R&T for specific class aircraft such as CTOL, STOL, V/TOL, rotorcraft, and supersonic cruise aircraft. Research in noise eduction, aircraft safety, improved approach and landing, and energy efficiency aircraft are discussed. A.R.H.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N78-28002 North Carolina Univ. at Chapel Hill.

AN ENTROPY MAXIMIZATION APPROACH TO THE DESCRIPTION OF URBAN SPATIAL ORGANIZATION Ph.D. Thesis

Robert Marsh Ray 1977 200 p

Avail: Univ. Microfilms Order No. 7801758

An alternative method of urban spatial distribution analysis is developed that is designed explicitly for quantative characterization of the structure of spatial associations existing between some set of areally distributed urban variables. The approach grows out of a particular combination, and in some instances generalization, of mathematical concepts developed previously within the areas of information theory, urban trip distribution modeling, and the theory of multidimensional scaling. From such a diversity of mathematical concepts there is constructed a pattern-information method of spatial distribution analysis that appears applicable to the study of geographically distributed urban phenomena in general. The particular information theoretic concepts developed lead directly to a cluster analysis procedure that is shown to be applicable to the analysis of structures of spatial associations determined among areally distributed urban variables. Dissert. Abstr.

N78-28003# General Accounting Office, Washington, D. C. Community and Economic Development Div.

MAKING FUTURE TRANSPORTATION DECISIONS: INTERMODAL PLANNING NEEDED

16 Mar. 1978 26 p

(PB-278526/9; CED-78-74) Avail: NTIS HC A03/MF A01 CSCL 13B

Interactions and relative costs and benefits between competing and complementary transportation modes are examined. To promote intermodal planning by State and local transportation agencies, the Secretary of Transportation should seek congressional legislation to consolidate Federal airport, highway, railroad, and transit planning grants into a block grant for all transportation planning, and merge the Department of Transportation's modal planning staffs into a single, all-mode unit. GRA

N78-28004# Durham Urban Observatory, N. C.

RESOURCE RECOVERY OPTIONS FOR DURHAM, NORTH CAROLINA Final Report

Alan E. Rimer and P. Aarne Vesilind Dec. 1977 141 p
(Contract HUD-H-2196R)
(PB-278685/3; UO-LCCM-DUR-77-016; HUD/RES-1290)
Avail: NTIS HC A07/MF A01 CSCL 13B

The availability of the resources both in Durham and the surrounding area, and the specific markets available for these resources were studied as well as technology options which the City could pursue, ranging from low technology such as separation of newspapers to such high technology options as the development of a regional resource recovery center. Recommendations include (1) formation of a task force representing a broad range of individuals to direct the resource recovery effort; (2) concentration on a multijurisdictional approach; (3) institution of a roll-out system of source separation on an interim basis; and (4) cooperation with the N. C. Public Utilities Commission on the use of refuse derived fuel in existing power facilities. GRA

N78-28005# California Univ., La Jolla.
DEVELOPMENT OF PERFORMANCE INDICATORS FOR TRANSIT Final Report, Oct. 1976 - Dec. 1977
Gordon J. Fielding, Roy E. Glauthier, and Charles A. Lave Dec. 1977 132 p refs Sponsored by DOT
(PB-278678/8; UMTA-CA-11-0014-78-1) Avail: NTIS HC A07/MF A01 CSCL 13B

Using operating and financial data collected from 47 public transit operators in California and 5 operators in Washington, selected performance indicators are analyzed for comparability of values between different modes of transit, different service area population densities, and different organizational types. The performance indicator values for selected transit properties are individually interpreted to demonstrate the analytic use and limitations of indicators. Potential uses of performance indicators are identified and areas requiring additional research described. Appendixes include: a literature search, a listing of properties, operating and financial data, and a glossary. GRA

N78-28006# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Chemical Systems Lab.
ANALYSIS OF CARBON VERSUS RESIN Technical Report, Jul. 1976 - Aug. 1977
James M. Szachta Mar. 1978 51 p refs
(DA Proj. 1L7-62720-D-048)
(AD-A053863; AD-E410006; ARCSL-TR-78013) Avail: NTIS HC A04/MF A01 CSCL 13/2

The objective of this study was to establish a comparative evaluation, to include economics, of using either carbon adsorption (with and without regeneration capacity), polymeric resin adsorption, or a series combination of the two techniques in effectively treating 'pink' water. Load, assembly, and pack facilities and ammunition manufacture facilities discharge wastewater which is contaminated with explosives such as TNT, RDX, HMX, and tetryl. These waters are referred to as pink water. Being photochemically active, the alpha-TNT in this wastewater chemically changes and forms toxic, colored compounds. To effectively treat this pink water, two different types of adsorption techniques are being considered: carbon and resin adsorption. Several studies have been conducted on the laboratory-, pilot-, and plant-scale levels concerning the treatment of pink water. Results of these studies prove that both activated carbon and amberlite XAD-4 are capable of treating pink water and thus are able to remove TNT and other nitrobodies such as RDX and HMX from munition waste streams to the target level of less than 1 ppm of total nitrobodies. These studies have generated the following conclusions: (1) amberlite XAD has greater capacity for TNT than has activated carbon, (2) activated carbon has a higher capacity for RDX, HMX, and tetryl and better color removal than has Amberlite XAD, (3) amberlite XAD is not completely effective in removing the color from a colored waste stream; if a waste stream were slightly colored, a carbon-polishing column placed after the resin column would remove the color, and (4) both adsorbents will provide similar nitrobody leakage for similar streams. GRA

N78-28007# Society of Automotive Engineers, Inc., Warrendale, Pa.
EVALUATION AND RECOMMENDATION OF ELECTRIC AND HYBRID VEHICLE PERFORMANCE STANDARDS Final Report
30 Sep. 1977 24 p ref
(Contract EC-77-C-01-5053)
(CONS/5053-1) Avail: NTIS HC A02/MF A01

A summary is presented of deliberations and recommendations of a task force having the following objectives: (1) identify an acceptable set of performance standards based on the work of two ERDA contractors; (2) identify and revise those performance standards which were found to be unacceptable; (3) identify the omission of important performance standards and suggest procedures to develop them; and (4) provide the task force rationale for the recommendations presented above. The Task Force recommends that ERDA identify the development of vehicle performance requirements as a specific task which is carried forward concurrently with the electric and hybrid vehicle test and demonstration program. ERA

N78-28008# Purdue Univ., Lafayette, Ind. Inst. for Interdisciplinary Engineering Studies.
OPPORTUNITY AND RISK ASSESSMENT OF THE ELECTRIC AND HYBRID VEHICLE RESEARCH DEVELOPMENT, AND DEMONSTRATION ACT OF 1976
Jan. 1978 330 p
(Contract EC-77-S-02-4250)
(HCP/M4250-01; COO-4250-1) Avail: NTIS HC A15/MF A01

The energy and environmental impact, technology, industry capabilities, market potential, institutional factors, service and demonstration facilities, and federal demonstration experience of electric and hybrid vehicles (EHV) were assessed. It is concluded that: (1) the technology of EHVs has potential for significant improvement over the next five to fifteen years; (2) present U.S. manufacturers of EHVs produce primarily for commercial and special purpose markets; (3) passenger EHV manufacturers has limited development experience and production facilities; (4) significant petroleum and environmental relief is possible with a commercial-market EHV strategy; and (5) available market research data are not suitable for EHV sales projections. ERA

N78-28009# Sandia Labs., Albuquerque, N. Mex. Applied Biology and Isotope Utilization Div.
EFFECTS OF HEAT, RADIATION, AND THERMORADIATION ON THE FILTERABILITY OF SEWAGE SLUDGE
Cecelia V. Carter Jan. 1978 33 p refs
(Contracts EY-76-C-04-0789; E(29-2)-3536; EPA-IAG-D6-0675)
(SAND-76-0312) Avail: NTIS HC A03/MF A01

Heat, radiation and thermoradiation effects on the dewatering properties of raw and primary digested sewage sludges were investigated. These effects were measured by observing the changes in filterability subsequent to treatment. Thermal treatment (40 to 95 C) of the sewage sludge resulted in decreased filterability. Radiation and thermoradiation treatment increased the filterability, with the increase being dose and temperature dependent. These treatment methods are not as effective as chemical additives in increasing the filterability of sewage sludge. The combined use of radiation and organic polymer conditioner shows no sigificant improvement in the filterability of sewage sludge over the use of polymer alone. There appears to be some interactions; however, it shows no useful synergistic effect. ERA

N78-28010# National Technical Information Service, Springfield, Va.
REGIONAL AND URBAN SOLID WASTE DISPOSAL PART 1: MANAGEMENT PLANNING. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Apr. 1978
Mona F. Smith Apr. 1978 231 p Supersedes NTIS/PS-77/0357; NTIS/PS-76/0301; NTIS/PS-75/184; NTIS/PS-74/105; NTIS-PK-151
(NTIS/PS-78/0403/2; NTIS/PS-77/0357; NTIS/PS-76/0301; NTIS/PS-75/184; NTIS/PS-74/105; NTIS-PK-151) Avail: NTIS HC $28.00/MF $28.00 CSCL 05B

Management, state, and local government policies, legislation, financing, data acquisition, and general planning studies for urban and regional solid waste disposal systems are cited. The topics covered public health, landfills, pollution, recycling, and load use. Studies on energy recovery and consumption, environmental impacts, land use, guidelines, and models are included. (This

updated bibliography contains 226 abstracts, 29 of which are new entries to the previous edition.) GRA

N78-28011# National Technical Information Service, Springfield, Va.
REGIONAL AND URBAN SOLID WASTE DISPOSAL. PART 2: LOCAL CASE STUDIES. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Apr. 1978
Mona F. Smith Apr. 1978 194 p Supersedes NTIS/PS-77/0358; NTIS/PS-76/0302; NTIS/PS-75/185
(NTIS/PS-78/0404/0; NTIS/PS-77/0358; NTIS/PS-76/0302; NTIS/PS-75/185) Avail: NTIS HC $28.00/MF $28.00 CSCL 05B

Case studies are cited on municipal waste disposal in specific cities, counties, or regions. Topics include aspects of collection, hauling, incineration, sanitary landfills, ocean dumping, and transfer stations as applied to a specific locale as well as management studies designed for these areas. (This updated bibliography contains 189 abstracts, 31 of which are new entries to the previous edition.) GRA

N78-28012# National Technical Information Service, Springfield, Va.
REGIONAL AND URBAN SOLID WASTE DISPOSAL. PART 3: HANDLING AND DISPOSAL TECHNOLOGY. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Apr. 1978
Mona F. Smith Apr. 1978 247 p Supersedes NTIS/PS-77/0359; NTIS/PS-76/0303; NTIS/PS-75/186
(NTIS/PS-78/0405/7; NTIS/PS-77/0359; NTIS/PS-76/0303; NTIS/PS-75/186) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

Reports covering the technology and techniques of collection, hauling, sorting, processing, disposal, incineration, and recycling of urban wastes are cited. The abstracts describe methods and equipment for waste handing, disposal, or reclamation. Studies on refuse derived fuels and energy consumption in solid waste processing are included. (This updated bibliography contains 242 abstracts, 49 of which are new entries to the previous edition.) GRA

N78-28013# Abt Associates, Inc., Cambridge, Mass.
MANUAL FOR EVALUATING SECONDARY IMPACTS OF WASTEWATER TREATMENT FACILITIES Final Report
Macolm Fitzpatrick, John Willson, Dean Ericson, Gene Fax, and Dianne Wood Feb. 1978 185 p refs
(Contract EPA-68-01-3268)
(PB-279153/1; EPA-600/5-78-003) Avail: NTIS HC A09/MF A01 CSCL 13B

Procedures for assessing secondary impacts of wastewater treatment facilities are described. The manual guides the user through this impact assessment process by describing EPA policy and regulations governing analysis of these impacts; approaches to refine and improve existing projections of amount, type and location of projected growth in a service area; and the range of potential secondary impacts and alternative approaches for impact assessment. Application of projection and impact assessment approaches are provided for various levels of sophistication, consistent with analysis capabilities and available resources. The manual also provides EPA regional reviewers with a convenient framework for evaluating quality of local analyses of secondary impacts and an analytic basis for imposing any needed special conditions. GRA

N78-28014# Transport and Road Research Lab., Crowthorne (England).
THE DYNAMIC RESPONSE OF A SINGLE WHEEL SUSPENSION TO COMPUTER GENERATED ROAD PROFILES
I. B. Laker 1978 32 p refs
(PB-279127/5; TRRL-SUPPLEMENTARY-360; ISSN-0305-1315) Avail: NTIS HC A03/MF A01 CSCL 13B

A method of computing road profiles of various roughness by filtering a random binary sequence is developed; the validity of a simulated profile is established by comparing the generated profile characterisitics with the power spectral density of measured profiles and also by making comparisons with the specification for construction of motorways. A single wheel, laden and unladen, commercial vehicle model was used. The simulation results show that over the motorway profile, at vehicle speeds of 64 km/h and 96 km/h, peak impact factors of 1.29 and 1.40 were generated in an unladen model suspension, the values reduced to 1.16 and 1.22 over a profile twice as smooth. In general an unladen suspension produced higher impact factors than when laden. GRA

N78-28015# Arkansas Univ., Little Rock. Industrial Research and Extension Center.
EFFECTS OF ENVIRONMENTAL PROTECTION REGULATION ON REGIONAL ECONOMIC DEVELOPMENT Final Report
Sep. 1977 143 p
(Grants EDA-99-7-13324; EDA-OER-516-G-76-7)
(PB-278918/8; PUB-L-12; EDA/OER-78/006) Avail: NTIS HC A07/MF A01 CSCL 10A

Current environmental protection legislation and energy problems are examined. The effects of these two intertwined forces on regional economic development are analyzed. Evaluations of both environmental-economic trade-off and industry attraction models are presented. GRA

N78-28016# Environmental Protection Agency, Washington, D. C. Office of Solid Waste Management Programs.
SOLID WASTE MANAGEMENT MANPOWER: PROFILE AND ANALYSIS
1978 63 p
(PB-279790/0; EPA-530/SW-161c) Avail: NTIS HC A04/MF A01 CSCL 05I

Management manpower involved in solid waste is considered. The analysis covers the manpower situation at the state level, the local operating level and in the area of resource recovery. The labor-management segment presents the reasons, results and solutions to problems between labor and management, and designs programs to produce incentive in workers. The impact of events on solid waste manpower examines cost pressures, enforcement of air pollution standards and financing of the system. Employment opportunities versus efficiency in management explores the situation of providing jobs while having to meet set environmental quality and efficiency standards. GRA

N78-28017# National Bureau of Standards, Washington, D. C. Applied Mathematics Div.
COMPARISON OF THE PERFORMANCE OF THREE ALGORITHMS FOR USE IN AN AUTOMATED TRANSIT INFORMATION SYSTEM (ATIS) Final Report
Judith F. Gilsinn, Elizabeth L. Leyendecker, and Douglas R. Shier Mar. 1978 167 p refs Sponsored in part by Urban Mass Transportation Administration, Washington, D. C.
(PB-279066/5; NBSIR-78-1426) Avail: NTIS HC A08/MF A01 CSCL 05B

Three algorithms for computing trip itineraries for use in an automated transit information system are computed. One of the approaches (TIMEXD) is based on a time-expanded network. The other two both compute paths in a bipartite route/stop network; one algorithm (LABCOR) is based on the label-correcting approach and the other (LABSET) on the label-setting approach. TIMEXD is fastest on all larger networks, but it requires most computer storage and outputs 'paths with more transfers. LABCOR is the slowest, but is guaranteed to produce the best routing, since it always outputs an optimal path with fewest transfers. GRA

N78-28018# Missouri Univ., Rolla.
AN INTRODUCTION TO THE TECHNOLOGY OF SUBSURFACE WASTEWATER INJECTION Final Report, 21 Jul. 1975 - 20 Jul. 1977
Don L. Warner and Jay H. Lehr Dec. 1977 358 p refs
(Grant EPA-R-803889)
(PB-279207/5; EPA-600/2-77-240) Avail: NTIS HC A16/MF A01 CSCL 13B

The design, construction, operation, and abandonment of subsurface wastewater injection systems is discussed. Local geologic and hydrologic characteristics of the injection and confining intervals are considered along with the physical, chemical, and biological compatibility of the receiving zone with the wastewater to be injected. Recommended pre-injection testing, operating procedures, and emergency precautions are included

as well as monitoring requirements, records maintenance, and proper well abandonment procedures. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N78-28019*# Pan American Univ., Edinburg, Tex.
LABORATORY STUDIES OF THE DIFFUSE REFLECTANCE SPECTRA OF FROSTS AND MINERALS OCCURRING ON ASTRONOMICAL OBJECTS Final Report
Frederic M. Glaser Jun. 1978 83 p
(Grant NsG-7278)
(NASA-CR-157298) Avail: NTIS HC A05/MF A01 CSCL 03A

A vacuum monochromator was integrated into the system and optics chosen to increase data collection in the infrared spectral region. Using a InSb detector, good reflectance data was obtained to 5.5 micron from a variety of samples including magnesium oxide, barium sulfate, water frost and Bloedite. Magnesium oxide was found to be a poorer reflector than the barium sulfate throughout the visible and near infrared region. The barium sulfate material was shown to be a Lambert reflector in the visible region and over an angular range of 60 deg. Several samples of water frost were prepared and in reflectance measured from 0.3 micron to 5.5 microm. The fine grained frosts were better reflectors than the coarse grained frosts, usually by 20 percent or more, over the entire spectral range. The minerals Bloedite and sulfur were also investigated further. A.R.H.

N78-28020*# Illinois Univ. at Urbana-Champaign, Urbana.
OBSERVATION AND INTERPRETATION OF LUNAR OCCULTATIONS Ph.D. Thesis
Richard Raeburn Radick 1978 114 p refs
(Grant NGR-14-005-176)
(NASA-CR-157293) Avail: NTIS HC A06/MF A01 CSCL 03A

The importance of timings and high resolution astrometry in occultation observations is discussed as well as the occultation process itself. The design and operation of the telescope, photodetector, and data acquisition systems are described. Methods are presented for data analysis and model fitting. Observations of beta Capricorni and Uranus occultations are examined. General conclusions concerning occultation observations are explored and future activities at Prairie Observatory are discussed. A.R.H.

N78-28021*# California Univ., Berkeley. Space Sciences Lab.
APOLLO-SOYUZ TEST PROJECT EXTREME ULTRAVIOLET TELESCOPE MA-083 Final Report
C. Stuart Bowyer 15 Jan. 1978 17 p refs
(Contract NAS9-13807)
(NASA-CR-151707; UCBSSL-Ser-18-Issue-76) Avail: NTIS HC A02/MF A01 CSCL 03A

Follow-on studies to the Apollo-Soyuz Extreme Ultraviolet Telescope experiment (MA-083) include analyses of individual target stars or classes of stars, not only with regard to the EUV data but also in connection with theoretical models and observations in other parts of the spectrum. Topics discussed include: observations of SS Cygni, Proxima Centauri, HZ 43, and Feige 24; computer searches for new EUV sources; Sirius: models and inferences; EUV emission from a hot gas; and the diffuse EUV background. A.R.H.

N78-28022*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OSO-8 X-RAY SPECTRA OF CLUSTERS OF GALAXIES. 2: DISCUSSION
Barham W. Smith, R. F. Mushotzky, and P. J. Serlemitsos Jul. 1978 59 p refs Submitted for publication
(NASA-TM-79577) Avail: NTIS HC A04/MF A01 CSCL 03A

X-ray spectral parameters obtained from 2 to 20 keV OSO-8 data on X-ray clusters and optical cluster properties were examined to obtain information for restricting models for hot intracluster gas structures. Topics discussed include the radius of the X-ray core in relation to the galaxy core radius, the viral mass of hotter clusters, and galaxy density and optical central cluster properties. A population of cool, dim X-ray clusters which have not been observed is predicted. The iron abundance determinations recently quoted for intracluster gas are uncertain by 50 to greater than 100 percent from this nonstatistical cause alone. A.R.H.

N78-28023*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A 4.8 HOUR PERIODICITY IN THE SPECTRA OF CYG X-3
R. H. Becker (Maryland Univ., College Park), J. L. Robinson-Saba (Maryland Univ., College Park), E. A. Boldt, S. S. Holt, S. H. Pravdo (Maryland Univ., College Park), P. J. Serlemitsos, and J. H. Swank Jul. 1978 19 p refs Presented at the 152d Am. Astronom. Soc. Meeting, Madison, Wis., 24-28 Jun. 1978 Submitted for publication
(NASA-TM-79579) Avail: NTIS HC A02/MF A01 CSCL 03A

The X-ray spectra from three observations of the X-ray binary Cyg X-3 by the cosmic X-ray spectroscopy experiment on OSO can be represented by power-law continua with strong iron line emission. Comparisons of spectra taken within the same observation at various phases of the 4.8 hour period reveal a relative excess of low energy X-ray emission near zero phase (i.e. the minimum) of the 4.8 hour modulation. In addition, the centroid of the line emission is observed to vary in phase with the 4.8 hour cycle. The possibility of persistent thermal X-ray emission from material surrounding the binary system is introduced in an effort to account for the observed effects. A.R.H.

N78-28024*# Cornell Univ., Ithaca, N. Y. Center for Radiophysics and Space Research.
OBSERVATIONS OF THE 51.8 MICRON (O III) EMISSION LINE IN ORION
Gary Melnick, George E. Gull, Martin Harwit, and Dennis B. Ward (David Dunlap Obs.) 1978 16 p refs
(Grant NGR-33-010-146)
(NASA-CR-157305; CRSR-688) Avail: NTIS HC A02/MF A01 CSCL 03A

The 51.8 micron fine structure transition P2:3P2 3P1 for doubly ionized oxygen was observed in the Orion nebula. The observed line strength is of 5 plus or minus 3 times 10 to the minus 15th power watt/sq cm is in good agreement with theoretical predictions. Observations are consistent with the newly predicted 51.8 micron line position. The line lies close to an atmospheric water vapor feature at 51.7 micron, but is sufficiently distant so that corrections for this feature are straightforward. Observations of the 51.8 (O III) line are particularly important since the previously discovered 88 micron line from the same ion also is strong. This pair of lines should, therefore, yield new data about densities in observed H II regions; or else, if density data already are available from radio or other observations, the lines can be used to determine the differential dust absorption between 52 and 88 micron in front of heavily obscured regions. A.R.H.

N78-28025*# Cornell Univ., Ithaca, N. Y.
FAR INFRARED POLARIZATION OF THE KLEINMANN-LOW NEBULA IN ORION
George E. Gull, James R. Houck, John F. McCarthy, William J. Forrest, and Martin Harwit 1978 20 p refs
(Grants NGR-33-010-146; NsG-7268; NGR-33-010-081)
(NASA-CR-157307; CRSR-695) Avail: NTIS HC A02/MF A01 CSCL 03B

Elongated dust grains aligned by local magnetic fields are though to absorb background radiation and produce linear and circular polarization which exhibit strong wavelength dependence

in the near infrared. The NASA Kuiper observatory 91 cm infrared telescope was used to observe polarization characteristics of the Kleinmann-Low nebula in four far infrared wavelength bands in order to detect emission from these same oriented grains at longer wavelengths, and determine whether this radiation shows a direction of polarization perpendicular to that seen in the near infrared. The polarization, if any, that characterized the radiation in the three longest wavelength filter positions (28-48 micron, 44-72 micron, and 70-115 micron) is small. The noisiest measurements were obtained in the 16-33 micron filter position. Possible explanations for the low polarization observed at long wavelengths are explored. A.R.H.

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N78-28026# Los Alamos Scientific Lab., N. Mex.
FLUCTUATIONS OF QUASARS AND OTHER ASTRONOMICAL SOURCES: NEW RESEARCH INITIATIVES PROGRAM W-210 Final Report
James Terrell Jan. 1978 29 p refs
(Contract W-7405-eng-36)
(LA-7092-MS) Avail: NTIS HC A03/MF A01

The power spectra of fluctuating light sources, the apparent expansion rates of astronomical sources exploding at relativistic speed, and the limits on fluctuation rates of such expanding (and nonexpanding) light sources were investigated. A study of the time history of such an exploding light source showed the falacy of a widely held belief that unusually rapid fluctuations of light output would be produced. This result has an important bearing on the interpretation of the redshifts of quasars and BL Lac objects, indicating that cosmological distance is very difficult to reconcile with the observations of rapid variations of luminosity. A list of publications is included. ERA

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N78-28027*+ National Aeronautics and Space Administration, Washington, D. C.
A BIBLIOGRAPHY OF PLANETARY GEOLOGY PRINCIPAL INVESTIGATORS AND THEIR ASSOCIATES, 1976-1978
May 1978 105 p
(NASA-TM-79732) Avail: NTIS HC A06 CSCL 03B

This bibliography cites publications submitted by 484 principal investigators and their associates who were supported through NASA's Office of Space Sciences Planetary Geology Program. Subject classifications include: solar system formation, comets, and asteroids; planetary satellites, planetary interiors, geological and geochemical constraints on planetary evolution; impact crater studies, volcanism, eolian studies, fluvian studies, Mars geological mapping; Mercury geological mapping; planetary cartography; and instrument development and techniques. An author/editor index is provided. A.R.H.

N78-28028*# National Aeronautics and Space Administration, Washington, D. C.
THE MODEL OF THE COMPOSITION OF THE MARTIAN ATMOSPHERE
M. N. Izakov and O. P. Krasitskiy Oct. 1977 40 p refs Transl. into ENGLISH from report PR-320 (Moscow), 1977 p 1-37 Transl. by Transemantics, Inc., Washington, D. C. Original document prepared by Academy of Sciences USSR, Moscow
(Contract NASw-2792)
(NASA-TM-75048) Avail: NTIS HC A03/MF A01 CSCL 03B

Global mean distributions of Martian atmospheric components concentrations from the planet's surface up to an altitude of 250 km are calculated. Improved data on the turbulent mixing coefficient, as a function of altitude, on temperature distribution and on chemical and photochemical reaction rates are used. The model data agree well with available measurements of some components concentrations. Variations of composition due to long-period variations of temperature, moisture and turbulent mixing are investigated. The relative significance of different catalytic cycles and the important role of excited atoms O (d-1) are revealed. L.S.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N78-28029 Utah Univ., Salt Lake City.
SOLAR RADIATION TRANSFER IN TWO-DIMENSIONAL CLOUDS Ph.D. Thesis
Sneh Keerti Varma 1977 141 p
Avail: Univ. Microfilms Order No. 7807208

A theoretical model for solar radiation transfer in a two-dimensional cloud is presented. This model assumes a cloud which has finite extent in the X- and Z-directions and an infinite extent in the Y-direction. The cloud consists of a homogeneous medium, which scatters the externally incident solar radiation and contains no internal emitters of radiation of thermal or other origin. A general case is considered in which the cloud absorbs and scatters the incident solar radiation. The steady state is considered; the cloud is not in motion, so that attention may be focused on the directional properties of radiation transport in the cloud. The source function involves only scattering processes; it includes contributions due to multiple scattering and single scattering of the direct beam. The resulting radiative transfer equation for this model is an integro-differential equation. Dissert. Abstr.

N78-28030 Colorado Univ. at Boulder.
WAVES IN INHOMOGENEOUS MOVING MEDIA WITH APPLICATION TO THE SOLAR WIND Ph.D. Thesis
Sylvan Arnold Jacques 1977 166 p
Avail: Univ. Microfilms Order No. 7808904

Consider a MHD system composed of waves and a slowly varying background fluid through which they propagate. A variational approach is used to derive a complete set of equations for the interacting wave-background system. The resulting fluid equations for the background state include terms which represent the momentum and energy flux of the wave. These equations are general in that they are valid for any MHD wave mode, and consistent in that both the total momentum and total energy of the system are conserved. To complete the system of equations the dispersion relation and the equation of conservation of wave action, which govern the wave amplitude are derived. The theory is applied to solar wind. Particular attention is given to high speed streams because their properties are probably more characteristic of the global solar wind than those of low speed flows. Several models are constructed for both the high and low speed solar wind for various varlues of the Alfven wave energy flux at the boundary ranging from 0 to 10,000 100,000 eg erg/sq cm sec for high speed flows and from 0 to 10,000 erg/sq cm sec for low speed flows.
Dissert. Abstr.

N78-28031*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A THREE-DIMENSIONAL MODEL OF COROTATING STREAMS IN THE SOLAR WIND. 1: THEORETICAL FOUNDATIONS
Victor J. Pizzo Jun. 1978 54 p refs Submitted for publication
(NASA-TM-79580) Avail: NTIS HC A04/MF A01 CSCL 03B

The theoretical and mathematical background pertinent to the study of steady, corotating solar wind structure in all three spatial dimensions (3-D) is discussed. The dynamical evolution of the plasma in interplanetary space (defined as the region

beyond roughly 35 solar radii where the flow is supersonic) is approximately described by the nonlinear, single fluid, polytropic (magneto-) hydrodynamic equations. Efficient numerical techniques for solving this complex system of coupled, hyperbolic partial differential equations are outlined. The formulation is inviscid and nonmagnetic, but methods allow for the potential inclusion of both features with only modest modifications. One simple, highly idealized, hydrodynamic model stream is examined to illustrate the fundamental processes involved in the 3-D dynamics of stream evolution. Spatial variations in the rotational stream interaction mechanism were found to produce small nonradial flows on a global scale that lead to the transport of mass, energy, and momentum away from regions of relative compression and into regions of relative rarefaction. A.R.H.

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N78-28032# National Technical Information Service, Springfield, Va.

COSMIC RAYS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1973 - Apr. 1978

Audrey S. Hundemann May 1978 293 p Supersedes NTIS/PS-77/0427, NTIS/PS-76/0328, and NTIS/PS-75/134 (NTIS/PS-78/0406/5; NTIS/PS-77/0427; NTIS/PS-76/0328; NTIS/PS-75/134) Avail: NTIS HC $28.00/MF $28.00 CSCL 04A

Measurement techniques, isotopic composition, distribution, intensity, anisotropy, and sources of cosmic rays are covered in the citations. GRA

99 GENERAL

N78-28033# Joint Publications Research Service, Arlington, Va.

TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: PHYSICAL SCIENCES AND TECHNOLOGY, NO. 39

30 Jun. 1978 86 p refs Transl. into ENGLISH from various Russian journals

(JPRS-71393) Copyright. Avail: NTIS HC A05/MF A01

Developments in various technological areas are reported. Specific topics covered include: improving information services; antenna reliability; gas bearings; space crew training; and future prospects for space exploration. For individual titles, see N78-28034 through N78-28042.

N78-28034# Joint Publications Research Service, Arlington, Va.

IMPROVING TECHNICAL INFORMATION SERVICES c82

V. Belousov and I. Zhelezhyaakov *In its* Transl. on USSR Sci. and Technol. (JPRS-71393) 30 Jun. 1978 p 9-12 Transl. into ENGLISH from Tekhn. i Nauka (Moscow), no. 4, 1978 p 31 (For primary document see N78-28033 18-99)

Copyright. Avail: NTIS HC A05/MF A01

The technical and organizational readiness of information services to operate in a unified information system is discussed. The organizer's function and dissemination of information are among the factors considered. J.M.S.

N78-28035# Joint Publications Research Service, Arlington, Va.

HOW TO IMPROVE THE RELIABILITY OF ANTENNA STRUCTURES c32

G. A. Savitsky *In its* Transl. on USSR Sci. and Technol. (JPRS-71393) 30 Jun. 1978 p 16-21 refs Transl. into ENGLISH from Vestn. Svyazi (Moscow), no. 2, Feb. 1978 p 29-30 (For primary document see N78-28033 18-99)

Copyright. Avail: NTIS HC A05/MF A01

Reliability to antennas is discussed in terms of construction, manufacturing, and quality control practices. Material selection, calculation of loads, proper operation and maintenance, and meteorological conditions are among the factors considered. J.M.S.

N78-28036# Joint Publications Research Service, Arlington, Va.

HOW TO REDUCE RADIO INTERFERENCE FROM HIGH-VOLTAGE ELECTRIC POWER TRANSMISSION LINES c33

V. V. Kapitonov and Yu. M. Abramson *In its* Transl. on USSR Sci. and Technol. (JPRS-71393) 30 Jun. 1978 p 22-25 Transl. into ENGLISH from Tekhn. i Nauka (Moscow), no. 2, Feb. 1978 p 33-34 (For primary document see N78-28033 18-99)

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Data from measurements of the radio frequency interference from overhead electric power transmission lines are presented. The quality of radio broadcast and television reception and expansion of reliable reception zones are emphasized. J.M.S.

N78-28037# Joint Publications Research Service, Arlington, Va.

INFLUENCE OF INERTIAL FORCES OF LUBRICANT FLOW ON THE STABILITY OF A SHAFT ROTATING ON RESILENT GAS DYNAMICAL PLAIN BEARINGS c37

A. S. Kelzon and V. I. Yakovlev *In its* Transl. on USSR Sci. and Technol. (JPRS-71393) 30 Jun. 1978 p 26-33 refs Transl. into ENGLISH from Mashinovedeniye (Moscow), no. 6, Nov. - Dec. 1977 p 19-23 (For primary document see N78-28033 18-99)

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The feasibility of suppressing auto-oscillations of gas bearings by setting the bearing's bushings in the resilient seats is demonstrated. The influence of inertial forces of the lubricant as well as the escape of gas are among the factors considered. J.M.S.

N78-28038# Joint Publications Research Service, Arlington, Va.

SPACE SUIT USED ABOARD SALYUT-6 DESCRIBED c54

G. Ilin and I. Pavlov *In its* Transl. on USSR Sci. and Technol. (JPRS-71393) 30 Jun. 1978 p 34-37 Transl. into ENGLISH from Aviats. Kosmonavt. (Moscow), no. 5, 1978 p 38 (For primary document see N78-28033 18-99)

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The organic semirigid pressure suit used aboard the Salyut-6 is described with emphasis on its use for extravehicular activity. The thermoregulation system, life support system, and the multilayered thermal insulation are among the factors considered. J.M.S.

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PROSPECTS FOR POWER GENERATION FROM SPACE c44

I. Zorich *In its* Transl. on USSR Sci. and Technol. (JPRS-71393) 30 Jun. 1978 p 38-41 Transl. into ENGLISH from Nedelya (Moscow), no. 20, 1978 p 11 (For primary document see N78-28033 18-99)

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The feasibility of generating electrical energy in space using either photoelectric batteries or solar collectors to convert solar energy to electrical energy is discussed. Methods of transmitting the converted energy to earth discussed include: laser beams and microwave radiation. Also, the possibility of placing industry in orbit near the source of energy to eliminate transmission costs is considered. J.M.S.

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COSMONAUTS UNDERGO MEDICAL GROUND TRAINING c52

N. N. Gurovskiy and A. D. Yegorov *In its* Transl. on USSR Sci. and Technol. (JPRS-71393) 30 Jun. 1978 p 42-49 Transl. into ENGLISH from Zemlya Vselennaya (Moscow), no. 2, 1978

p 11-15 (For primary document see N78-28033 18-99)
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Cosmonaut selection criteria and the medical training system developed to guarantee maintenance of health and working ability under space flight conditions are described. Endurance tests to increase tolerance to accelerations, weightlessness, and psycho-neural stresses and to improve overall fitness are included.
J.M.S.

N78-28041# Joint Publications Research Service, Arlington, Va.

FEOKTISTOV INTERVIEWED ON FUTURE OF SOVIET COSMONAUTS **c12**

K. P. Feoktistov and S. Vlasov *In its* Transl. on USSR Sci. and Technol. (JPRS-71393) 30 Jun. 1978 p 50-55 Transl. into ENGLISH from Ogonyek (Moscow), no. 15, Apr. 1978 p 14-16 (For primary document see N78-28033 18-99)
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Various aspects of future developments in space exploration are reviewed. Ability of man to withstand long duration space flights, possibility of man living in space, construction of space habitats and industrial plants, orbiting electric power plants, and development of more efficient propulsion systems are among the subjects discussed. Urban and industrial development of the moon are included.
J.M.S.

N78-28042# Joint Publications Research Service, Arlington, Va.

SPACECRAFT CREW GROUND TRAINING DESCRIBED **c53**

A. G. Nikolyev *In its* Transl. on USSR Sci. and Technol. (JPRS-71393) 30 Jun. 1978 p 56-65 Transl. into ENGLISH from Zemlya Vselennaya (Moscow), no. 2, 1978 p 5-10 (For primary document see N78-28033 18-99)
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Various aspects of the cosmonaut training program are outlined. Specific topics discussed include: (1) flight and parachute training; (2) cosmonaut study of the spacecraft, the station, and their systems; (3) flight simulation trainer; and (4) preparation for conduct of scientific, technical, and biomedical experiments and studies.
J.M.S.

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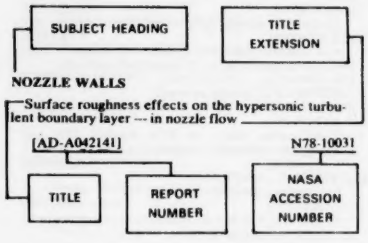

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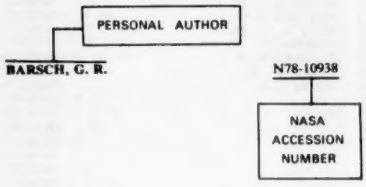

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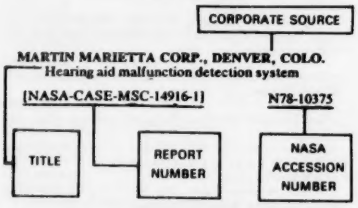

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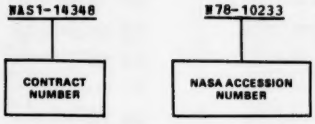

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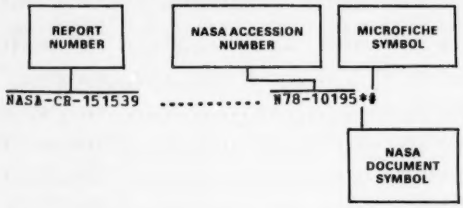

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